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NYASALAND PROTECTORATE

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# Annual Report

of the

# Department of Agriculture

# 1936

NYASALAND PROTECTORATE

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A. Report of the Entomologist.

B. Report of the Plant Pathologist, Mlanje Experimental Station.

C. Report of the Agricultural Officer, Dowa.

D. Report of the Agricultural Officer, Lower Shire and Chikwawa, Port Herald Experimental Station.

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# Report of the Director of Agriculture.

## PART I.—Agriculture in Nyasaland.

### Weather Conditions.

The weather conditions during the season 1935-36 in Nyasaland were generally not good. The early rains were very localised, a characteristic which continued later than usual. The mid-season was characterised by general heavy rains. Rainfall during March in the Southern Province was slightly in excess of normal and this was accompanied by a long spell of dull days and low temperatures. The season in general was not good for the growth of leguminous crops. The tea belts experienced fair growing weather and most cereals yielded fairly well. The various factors including weather which affected the growth of cotton are dealt with in the report of the Entomologist.

As far as tobacco is concerned, weather during the seed-bed period was good. Many plantings were made in southern areas towards the end of November. Weather conditions during December cannot be said to have been generally good, the greater proportion of the rain being in heavy falls during the period December 13th to 22nd. During January the weather was characterised by hot dry spells, particularly in the northern part of the dark tobacco areas of the Northern Province. Good growing conditions were experienced at high and medium elevations in Dedza, Ncheu, Zomba, Mlanje and Blantyre. The localised character of the rainfall was continued for several days during early February but heavy rains commenced in most southern areas about the 12th and continued to the end of the month. Excessive rains were experienced particularly in and around Zomba, the heaviest falls for February being recorded since 1906. North of Ncheu and Golomoti, again, as far as Lilongwe, rains in this critical month were much in excess of normal. Much of Dowa and Kota Kota also experienced excessive rains.

Rainfall during March in the Southern Province was generally slightly in excess of normal and was accompanied by a long spell of dull days and low temperatures. Following on the excessively wet February, these conditions had an adverse effect on the growth of much tobacco. Similar conditions occurred in many parts of the Northern Province, particularly in Dedza, southern Lilongwe, the Dowa highlands and Kota Kota.

Conditions during April in most northern areas were about normal with small showers throughout the month. Elsewhere in southern and central tobacco areas rainfall was slightly below normal with much overcast weather and temperatures lower than normal. May and June were fine with a tendency towards low temperatures.

To sum up, the weather conditions in nearly all tobacco areas were not conducive to good growth and ripening and this was reflected in the quality of the crop which was subsequently harvested and sold.

The totals for the six wet months and the six dry months for various localities are shown in the accompanying table.

| | Zone | Total rainfall November 1, 1935, to April 30, 1936 | Normal for six wet months | Total rainfall May 1, to October 31, 1936 | Normal for six dry months |
|---|---|---|---|---|---|
| | | Inches | Inches | Inches | Inches |
| Port Herald | A | 40.09 | 29.1 | 2.17 | 3.6 |
| Port Herald Experimental Station | | 42.88 | 28.8 | 7.46 | 3.2 |
| Chikwawa | ... | 36.55 | 29.7 | 3.44 | 2.3 |
| Cholo | B | 52.46 | 48.8 | 9.02 | 8.1 |
| Makwasa | ... | 61.55 | 46.8 | 8.15 | 4.4 |
| Nsikisi | ... | 57.15 | — | 9.06 | — |
| Lipumulo | ... | 47.49 | — | 6.98 | — |
| Mikundi | ... | 56.77 | — | 9.03 | — |
| Upper Mboma | ... | 52.65 | — | 10.13 | — |
| Masambanjati | ... | 68.48 | — | 16.01 | — |
| Mlanje | C | 71.48 | 66.6 | 14.66 | 14.5 |
| Chitakali | ... | 81.98 | 65.5 | 29.77 | 12.1 |

| | Zone | Total rainfall November 1, 1935, to April 30, 1936 | Normal for six wet months | Total rainfall May 1, to October 31, 1936 | Normal fo six dry months |
|---|---|---|---|---|---|
| | | Inches | Inches | Inches | Inches |
| Thornwood | | 76.92 | 67.8 | 12.31 | 11.6 |
| Ruo | | 63.11 | 53.7 | 13.00 | 6.3 |
| Glenorchy | | 62.06 | 56.2 | 12.88 | 10.1 |
| Sayama | | 75.21 | 56.0 | 12.22 | 10.5 |
| Lujeri | | 92.26 | 76.3 | 21.70 | 14.3 |
| Chisambo | | 99.80 | — | 21.49 | — |
| Nalipiri | D | 60.40 | 51.9 | 16.52 | 11.0 |
| Blantyre | E | 60.88 | 39.9 | .92 | 3.3 |
| Limbe Catholic Mission | | 47.42 | — | 5.29 | — |
| Chingaluwe | | 46.07 | 42.8 | 4.65 | 3.3 |
| Nyambadwe | | 50.20 | 39.0 | 1.20 | 2.9 |
| Chiradzulu Boma | | 38.22 | 40.0 | 3.06 | 2.5 |
| Nyungwe | | 37.42 | — | .92 | — |
| Michiru | F | 27.85 | 35.3 | 1.26 | 2.0 |
| Namalanga | G | 24.55 | 29.9 | 3.70 | 1.0 |
| Nasonia | | 38.97 | 36.9 | 8.19 | 1.9 |
| Zomba Experimental Station | H | 51.78 | 46.8 | 1.73 | 4.6 |
| Zomba Plateau | | 63.31 | — | 8.15 | — |
| Likwenu | | 57.91 | — | .33 | — |
| Police Headquarters | | 52.66 | 41.9 | 1.08 | 1.8 |
| Domasi | | 52.57 | 52.7 | — | — |
| Nankunda | | 81.63 | — | — | — |
| Malosa | | 58.21 | -- | .70 | — |
| Mbidi | I | 41.68 | 35.8 | — | 1.5 |
| Makwapala Experimental Station | | 46.95 | 34.0 | 1.15 | 1.5 |
| Mwanza | K | 46.99 | 37.2 | 5.70 | .6 |
| Liwonde | L | 28.72 | 31.7 | .81 | 1.1 |
| Bilila | | 27.98 | 28.0 | — | .7 |
| Mandimba | M | 39.61 | 34.0 | — | .3 |
| Namwera | | 40.11 | 42.2 | 1.50 | .3 |
| Chipunga | | 42.32 | 35.0 | 1.04 | .8 |
| Fort Johnston | N | 31.24 | 29.4 | .55 | 1.2 |
| Monkey Bay | | 23.16 | 29.2 | .02 | .9 |
| Malindi | | 44.35 | — | — | — |
| Golomoti | | 42.59 | 29.5 | — | .1 |
| Ncheu | P | 39.16 | 37.0 | .49 | .9 |
| Likuni | S | 32.71 | 32.9 | 1.00 | 1.5 |
| Chimvua | | 35.10 | — | 1.01 | — |
| Lilongwe | | 31.36 | 32.7 | 1.10 | .8 |
| Nathenje | | 33.68 | — | .37 | — |
| Mpali | T | 38.34 | — | — | — |
| Dowa | | 32.63 | 33.1 | .51 | .7 |
| Fort Manning | | 33.87 | 39.8 | 3.03 | 2.5 |
| Domira Bay | U | 34.23 | 31.0 | .17 | .1 |
| Dedza | V | 45.31 | 39.7 | .61 | 2.2 |
| Kasungu | X | 37.48 | 29.1 | .11 | .3 |
| Mzimba | | 36.27 | 31.7 | — | .2 |
| Kota Kota | Y | 67.14 | 48.2 | 2.95 | 2.0 |
| Chinteche | Z | 68.45 | 62.9 | 11.80 | 5.1 |
| Livingstonia | | 83.66 | 57.5 | 2.30 | 6.2 |
| Karonga | | 37.06 | 52.3 | 1.50 | 2.8 |
| Salima | | 43.96 | — | .23 | — |
| Glengary | | 64.19 | — | 12.46 | — |

## Production and Export.

European production and acreages of the principal crops over the past three years are shown in the following table. Weights are given in long tons of 2,240 lbs.

| | 1934 | | 1935 | | 1936 | |
|---|---|---|---|---|---|---|
| | Acres | Yields | Acres | Yields | Acres | Yields |
| Tea ... ... | 15,414 | 4,449,312 lb. | 16,054 | 5,730,704 lb. | 16,346 | 7,372,316 lb. |
| Coffee ... ... | 1,188 | 1,039 cwt. | 995 | 1,605 cwt. | 836½ | 533¼ cwt. |
| Tobacco ... ... | 8,350 | 3,895,136 lb. | 6,144 | 2,112,096 lb. | 7,349¼ | 2,663,360 lb. |
| Sisal ... ... | 9,785 | — | 9,785 | — | 1,547 | 8,200 cwt. |
| Cotton (lint) ... | 1,501 | 2,451 cwt. | 2,067 | 2,016 cwt. | 1,997 | 1,920¼ cwt. |
| Rubber ... ... | 1,300 | — | 1,300 | 159,936 lb. | 1,300 | 1,607 cwt. |

Native production and numbers of growers of the two principal crops, *viz.*, cotton and tobacco, are shown below.

| | 1934 | | 1935 | | 1936 | |
|---|---|---|---|---|---|---|
| | No. of growers | Amount sold | No. of growers | Amount sold | No. of growers | Amount sold |
| Cotton (seed cotton) ... | 28,970 | 5,377 tons | 70,199 | 11,237 tons | 66,159 | 6,381 tons |
| Tobacco ... ... | 60,247 | 5,054 tons | 49,529 | 4,594 tons | 66,602 | 6,170 tons |

Cotton growers refer to Crown land only; figures of private estate (tenant) growers are not known.

The exported amounts and values of the various items of agricultural produce and of raw materials are given for the past three years in the table that follows.

| | 1934 | | 1935 | | 1936 | |
|---|---|---|---|---|---|---|
| | Amount | Value £ | Amount | Value £ | Amount | Value £ |
| Capsicums and chillies ... | 41,398 lb. | 517 | 47,869 lb. | 598 | 12,129 lb. | 151 |
| Coffee ... ... | 366 cwt. | 688 | 603 cwt. | 1,127 | 337 cwt. | 628 |
| Maize and maize flour ... | 300,000 lb. | 335 | 20,185 lb. | 23 | 1,203,513 lb. | 1,345 |
| Potatoes ... ... | 98,858 lb. | 451 | 113,960 lb. | 477 | 83,279 lb. | 335 |
| Tobacco ... ... | 12,544,126 lb. | 470,405 | 10,168,641 lb. | 296,929 | 13,391,541 lb. | 390,587 |
| Tea ... ... | 4,624,111 lb. | 171,470 | 6,042,532 lb. | 223,876 | 7,706,088 lb. | 256,870 |
| Beeswax ... ... | 197 cwt. | 1,104 | 92 cwt. | 445 | 232 cwt. | 1,083 |
| Cotton (lint) ... ... | 1,851 tons | 102,876 | 3,658 tons | 204,850 | 2,375 tons | 133,007 |
| Cotton seed ... ... | 3 tons | 6 | 1,183 tons | 2,366 | 1,679 tons | 3,357 |
| Fibre (all kinds) ... | 435 lb. | 2 | 355 lb. | 1 | 418 tons | 3,346 |
| Groundnuts ... ... | 214 tons | 1,068 | 20 tons | 103 | — | — |
| Rubber ... ... | 22,041 lb. | 92 | 131,760 lb. | 549 | 206,535 lb. | 861 |
| Strophantihus ... | 9,610 lb. | 1,441 | 9,646 lb. | 964 | 16,191 lb. | 1,619 |
| Rice ... ... | 3,106 lb. | 14 | 250 lb. | 1 | — | — |

The most notable increases of exports during 1936 were in tea, tobacco, fibre and soya beans, which first figured as an appreciable export.

In the case of tea, the increase of 27.5 per cent. was due to improved yields per acre, the improvement in price and the coming into bearing of new acreages. The increase in tobacco production was due to a large increase in the number of registered native growers, amounting to increases of 47.7 per cent. in the Northern Province and 54.8 per cent. in the Southern Province. The increase in the total tobacco crop was only 26.4 however due largely to weather conditions. (see also report on native-grown tobacco for 1935—36 season issued by the Native Tobacco Board). The increase in fibre was due to the re-opening of estates in lower river areas due largely to the increase in value of sisal.

It is unfortunate that the increase in cotton production anticipated up to the mid-season of 1936 was not realised. The reasons for this require careful examination as weather entirely cannot be blamed. Insect damage was very extensive and the Entomologist has gone fully into these aspects in his report.

There was an appreciable increase in the production of rubber. The one rubber estate in West Nyasa extended its operations considerably.

The average prices paid for native tobacco were slightly lower than in 1935, especially in the Northern Province, due to the lowered quality of the crop. The amount sold in central buying stations was much in excess of the estimate. It is attempted to control the amount of native dark tobacco produced according to market conditions but in the year under review some over-production of certain types and grades could not be avoided.

## Tobacco.

The total figures of tobacco production for 1936 show in comparison with the figures of the previous year a considerable increase.

The actual figures are given in the following table along with the 1935 figures.

| *Production* | 1935 | | 1936 | |
|---|---|---|---|---|
| European | lb. | lb. | lb. | lb. |
| Flue-cured ... ... | 1,492,400 | | 2,109,128 | |
| Fire-cured ... ... | 497,392 | 2,112,096 | 472,808 | 2,663,360 |
| Air-cured ... ... | 122,304 | | 81,424 | |
| Native | | | | |
| Fire-cured ... ... | | 10,291,560 | | 13,821,718 |
| | | 12,403,656 | | 16,485,078 |

The increase in production was reflected in an increase of exports.

| *Exports* | 1935 | | 1936 | |
|---|---|---|---|---|
| | Amount lb. | Value £ | Amount lb. | Value £ |
| Flue-cured ... | 1,020,107 | 29,980 | 1,608,079 | 46,903 |
| Fire-cured ... | 8,704,943 | 254,012 | 11,001,797 | 320,886 |
| Air-cured ... | 443,591 | 12,937 | 781,665 | 22,797 |
| | 10,168,641 | 296,929 | 13,391,541 | 390,586 |

At the end of 1936, stocks of Nyasaland tobacco in the United Kingdom stood at 30,406,117 lb a $2\frac{5}{12}$th years' supply on the usual basis. Consumption of Nyasa tobacco during 1936 amounted to 12,450,261 lb. being a decrease of 74,854 lb. on that of the previous year and representing 26 per cent. of all Empire tobacco consumed. The figure compares with 28.2 per cent. for 1935.

Exports of tobacco from Nyasaland in 1936 amount to 9,283,624 lb. of leaf and 4,107,917 lb. of strips. There is an excess of 588,793 lb. in deliveries over imports into the United Kingdom during 1936 which compares favourably with the following figures for other Empire countries.

| | Excess lb. |
|---|---|
| Southern Rhodesia ... ... ... ... | 3,130,387 |
| India ... ... ... ... ... ... | 1,010,994 |

It is apparent that the point of production of most types and grades of tobacco was on the safe side and that stocks are likely to be considerably reduced in 1937. Exports of Nyasa dark leaf to West African dependencies amounted to 199,649 lb., while small quantities went to Tanganyika, Dutch East Indies and Egypt.

*European.*—Acreages and yields are given by districts in Appendix I. The crop was disposed of as follows:

| | Flue-cured lb. | Fire-cured lb. | Air-cured lb. | Total lb. |
|---|---|---|---|---|
| Sold locally ... | 1,779,792 | 341,936 | 78,288 | 2,200,016 |
| Exported direct ... | 118,272 | 96,768 | 896 | 215,936 |
| Left on hand ... | 211,064 | 34,104 | 2,240 | 247,408 |

In comparison with 1935 the figures are as follows:—

| | 1935 lb. | 1936 lb. |
|---|---|---|
| Sold locally ... ... ... | 1,761,872 | 2,200,016 |
| Exported direct ... ... ... | 196,672 | 215,936 |
| Left on hand ... ... ... | 153,552 | 247,408 |

European tobacco occupied 7,349 acres as compared with 6,144 acres in 1935 while production totalled 2,663,360 lb. as against 2,112,096 lb. in 1935. The total was made up of 2,109,128 lb. flue-cured, 81,424 lb. air-cured and 472,808 lb. dark-fired leaf. The state of the industry was such that Government found it expedient to give advances to planters during the 1936 season. The 1935 season was not financially favourable to European growers and it is somewhat alarming to note that many of these growers are still attempting to produce bright tobacco in areas where the climatic conditions are usually quite different to those prevailing during the average growing season in the bright tobacco belts of the United States of America. It is computed that nearly 25 per cent. of these European growers are planting in unsuitable or 'border line' areas near the tea belts.

In addition to the factors of high rainfall and humidity in the normal year which preclude the production in these areas of bright tobacco with a high yield and of good quality the great variation in the soils both over a short distance in the average field with a considerable slope and over the area as a whole makes it impossible to fertilise or to carry out certain cultural operations in a uniform and proper way. It is impossible to obtain experimental results which are both significant and useful to the body of tobacco growers in such areas. Furthermore the aroma of their production is often spoken of as somewhat undesirable and certain grades are said to have a tang. It is clear that much of this tobacco does not ripen properly and it is often impossible to harvest and cure the crop with a uniform colour and enzyme change.

Legislation was passed in 1936 to enable the marketing of flue-cured tobacco surplus to local requirements to be done with advantage to the grower and power is given by this legislation to a control board to form a pool and use certain funds available for finding new outlets for bright leaf.

*Native.*—In the Northern Province as has been seen, the season was not good and the quality of the crop generally left much to be desired.

The average amounts produced per grower on native trust land were 183 lb. in the Northern Province and 251 lb. in the Southern Province. The number of registered crown-land growers were respectively 43,177 and 10,419, these figures representing increases of 47.7 and 54.8 per cent. in comparison with the 1935 figures. The amounts of dark tobacco purchased from native crown-land and private estate growers are given under provinces in the following table.

| | Northern Province lb. | Southern Province lb. |
|---|---|---|
| Crown land ... ... | 7,908,847 | 2,616,712 |
| Private estates ... ... | 2,093,419 | 1,202,740 |
| | 10,002,266 | 3,819,452 |

The total figure for the dark tobacco crop produced by native growers was thus 13,821,718 lb. The corresponding figure for 1935 was 10,291,560 lb.

The district details of Crown-land tobacco sold in the two Provinces are given here. The figures for the 1935 crop are quoted for comparison and decreases and increases are shown.

| | 1935 lb. | | 1936 lb. | | lb. |
|---|---|---|---|---|---|
| **Northern Province** | | | | | |
| Ncheu ... ... | 146,785 | ... | 306,287 | + | 159,502 |
| Fort Manning ... | 43,427 | ... | 139,305 | + | 95,878 |
| Lilongwe ... ... | 3,435,957 | ... | 4,996,903 | + | 1,560,946 |
| Dowa ... ... | 2,497,240 | ... | 2,466,352 | − | 30,888 |
| Total ... ... | 6,123,409 | ... | 7,908,847 | + | 1,785,438 |
| **Southern Province** | | | | | |
| Mlanje ... ... | 641,381 | ... | 1,215,564 | + | 574,183 |
| Cholo ... ... | 18,030 | ... | 18,900 | + | 870 |
| Blantyre ... ... | 183,954 | ... | 307,100 | + | 123,146 |
| Chiradzulu ... ... | 381,550 | ... | 798,785 | + | 417,235 |
| Zomba ... ... | 128,615 | ... | 217,464 | + | 88,849 |
| Upper Shire ... ... | 30,193 | ... | 58,899 | + | 28,706 |
| Total ... | 1,383,723 | ... | 2,616,712 | + | 1,232,989 |
| Grand Total ... | 7,507,132 | ... | 10,525,559 | + | 3,018,427 |

The buying stations of the Native Tobacco Board in the Northern Province opened on May 26. Buying in the Southern Province commenced a few weeks earlier. Buying licences numbered 122 in all. The amounts purchased at the buying stations were as follows.

| | lb. |
|---|---|
| Nsaru ... ... ... | 1,791,502 |
| Lombadzi ... ... ... | 1,054,336 |
| Nathenje ... ... ... | 2,151,065 |
| Mponela ... ... ... | 2,466,352 |
| | 7,463,255 |

Purchases in the uncontrolled areas of Fort Manning and Ncheu amounted to 445,592 lb.

## Cotton.

*Native.*—It has already been mentioned that the production of native grown cotton decreased and the reasons have been gone into elsewhere.

In the Lower River the crop amounted to 4,653 tons of seed cotton, a decrease of 28 per cent. from the 1935 figure. In the central area of the Southern Province, the production was 657 tons as against 1,429 tons in the previous year, while in the area between northern Ncheu and Kota Kota production dropped from 1,774 to 984 tons of seed cotton. The production of cotton on crown-land, inclusive of 87 tons in North Nyasa, was thus 6,381 tons Private estates accounted for 882 tons, and the total for the country was therefore 7,263 tons ; the figure for 1935 was 11,237 tons. Export amounted to 13,301 bales ; the 1935 figure was approximately 20,485 bales.

The average price for No. 1 grade was 1.428d., for No. 2 .926d. and for No. 3 .639d. It is estimated that the sum of £75,451 was paid to crown-land growers and that of that sum £59,646 was paid for No. 1 grade. The production factor per pound of seed issued was 4.8 in the lower River, 1.9 in the central part of the Southern Province and .4 in the area of the northern extension of the railway from Ncheu to Kota Kota. The percentage of No. 1 grade in the crown-land crop was 70.1.

Details of crown-land and private-estate seed-cotton production by districts are as follows:—

| Southern Province | tons | Northern Province | tons |
|---|---|---|---|
| Lower Shire ... ... | 2,600 | Ncheu ... ... | 164 |
| Chikwawa ... ... | 2,349 | Dedza ... ... | 412 |
| Cholo ... ... | 159 | Dowa ... ... | 692 |
| Mlanje ... ... | 114 | Kota Kota ... ... | 146 |
| Central Shire ... ... | 333 | North Nyasa ... ... | 90 |
| Blantyre ... ... | 75 | | |
| Chiradzulu ... ... | — | | 1,504 |
| Zomba ... ... | — | | |
| Upper Shire ... ... | 40 | | |
| South Nyasa ... ... | 89 | | |
| | 5,759 | | |

*European.*—European production of seed cotton amounted to 295 tons as against 303 tons in 1935.

## Tea.

The tea industry continued to expand towards its limit of 17,700 acres under the restriction scheme. The acreage planted during 1936 was 292, and the total at the end of the year was 16,346 acres of which 8,710 acres were in Mlanje and 7,636 acres in Cholo. Production of tea rose from 5,730,704 lb. in 1935 to 7,372,316 lb. in 1936 while exports, as already noted, increased by 27.5 per cent. The acreage in plucking was 14,385. The industry is still busily engaged in consolidating its position in view of the approach of the end of the present five-year period of restriction in March, 1938.

Investigations were continued during 1936 in the problem of poor fermentation of leaf from certain soils in the high-rainfall belt of Mlanje and it has now been proved that a supply of certain minor elements to tea bushes in this area will temporarily rectify the trouble. A dilute solution of copper sulphate applied as a spray will cause an improvement in leaf plucked from such bushes, the improvement lasting for some months and the quality and value of the made tea being much appreciated.

Experimental work on works for minimising soil erosion, fertilizing, pruning methods and degrees of plucking has continued and results of various investigations have been published.

## Coffee.

The European coffee acreage continues to shrink. Figures for the past three years are given below.

| | Total acreage | Production cwt. | Amount exported cwt. |
|---|---|---|---|
| 1934 ... | 1,188 ... | 1,039 ... | 366 |
| 1935 ... | 995 ... | 1,605 ... | 603 |
| 1936 ... | 837 ... | 533 ... | 168 |

It is apparent that there are few true coffee areas in Nyasaland, the long dry season and attack by white stem borer being limiting factors in the long life of the coffee tree in doubtful areas. It may be laid down that the limit of coffee areas in Nyasaland may be traced on the dry season rainfall map by the 7-inch isohyet.

Parts of the Cholo hills receive more than this rainfall in the average six-monthly period, May to October inclusive, and this is reflected in the superior results being obtained among native cultivators in these areas.

## Other Crops.

The re-opening of sisal estates in Lower River areas and the production of rubber in West Nyasa has been referred to.

The European acreage under tung oil increased from 341 acres in 1935 to 624 acres during the 1936 season but at the beginning of the 1937 season, a further 300 acres was planted. Most of this acreage was planted in Cholo, Mlanje and Zomba, *Aleurites montana* forming the greater proportion in the drier areas.

Work on this species on the Zomba Experimental Station has now enabled a bulletin to be prepared on all aspects and this will be shortly published.

## Native Food Crops.

Maize, the staple cereal food of the country, yielded quite well in Lower River areas, Mlanje and Cholo although late floods spoilt some maize at Chikwawa and Chiromo. In other areas of the Southern Province, in Dedza, Ncheu and north of Dowa, maize and other food crops were good, notable exceptions being small parts of the South Nyasa, Upper Shire districts where the shortage of early rains almost ruined the food gardens. There was actual famine early in the year along the east side of Lake Nyasa. Maize in dry areas south of the Bua was also adversely affected by the early weather conditions. It is to be noted that in the high rainfall areas the native grown types of maize have suffered less from cob diseases than the small flat white types.

Good crops of pearl millet were harvested in areas of low elevation although fungus disease was apparent at higher elevations.

Groundnuts and beans were in short supply generally owing to the large amount of rosette disease during this and the previous season which resulted in very small amounts of seed available.

Root crops such as cassava and sweet potatoes were generally very good.

Crops in most northern areas particularly North Nyasa were excellent although the usual local shortage occurred in Mzimba.

It is to be noted that disappointing results are obtained on many soils in the highland areas with the cow pea and dolichos bean in the normal year and it is very apparent that other leguminous crops are urgently required in the permanent agriculture of such areas. Work during the past ten years on the Zomba Experimental Station has shewn the great value of the soya bean as a food and rotation crop and it is proposed to continue with extensive propaganda everywhere to popularize this crop by field and cooking demonstrations. Pigeon pea has also been shown to be a valuable rotation and fodder crop but unfortunately it yields very poorly in areas where the winter is characterised by very cold nights.

Issues of good seed of the chief food crops and of seed of improved varieties have been made from all experimental stations, mainly of rice and pearl millet at lower elevations and groundnuts and maize in highland areas.

## Pests and Diseases.

(See also Appendices A and B).

*Locusts.*—The red-winged locusts, *Nomadacris septemfasciata*, Serv., was the only species occurring in the Protectorate during the year. The development of adults of the 10th generation was, generally, on a less intense scale than in previous years. The scattered, quiescent nature of the hopper bands in some areas was again noticeable, and in the Domira Bay area *dissocians* phase habits were conspicuous in the small resulting swarms.

A prolonged hopper period and late developing hopper bands were also recorded, though in the Lower Shire and Chikwawa districts a fairly normal developmental period was, once again, a feature of these districts.

The first flying swarms of the 10th generation developed in March and by April most hopper bands had reached the adult stage. Vacation of the lower levels by these swarms occurred as usual, but dull weather with high humidity during the middle of the year appeared to check any concentrated flights, and a very irregular circling movement in the Shire Highlands as a whole continued for the main part of the year. It was not until well on into December that a definite north and north-west movement set in, and it was then observed that there appeared to be a heavier infestation in the Protectorate than previous evidence had indicated. Some of these swarms penetrated districts of the Northern Province, Dowa and Kota Kota, which had been free nearly the whole year. Except for an occasional swarm entering from Northern Rhodesia, however, the three most northern districts, North Nyasa, Mombera and Kasungu, have not been invaded this year.

Damage done, both by hopper bands and adult swarms, was considerably less than in previous years.

*Crop pests.*—The Entomologist in addition to considerable work on the locust problem gave much attention to pests of tung oil, olive, coffee and especially cotton.

*Crop diseases.*—The Plant Pathologist is stationed on the tea experimental station in Mlanje and his work continues to be concerned with tea diseases in the first place. A special study of the *Armillaria* root disease has been made and the results will shortly be published. Other work has included studies of citrus diseases such as exanthema and mottle leaf. Much experimental work in the field on various aspects of tea culture was also carried out.

## Advisory Bodies and Policy.

The Board of Agriculture met to transact business appertaining to the extended cultivation of tung oil in the highland areas. It is evident that a large central oil extraction plant will soon be required in the Cholo district and that such a plant will be far more economical than numerous small ones.

The Native Welfare Committee continued to advise Government on the co-ordination of the work and policies of those departments in whose hands lie the main responsibility for native development and general advancement and on matters bearing on native welfare in general. The Director of Agriculture is a member of this committee, the aim of whose work has been described in the Annual Report for 1935.

As far as the Department of Agriculture is concerned, such matters as better food, better animal husbandry and better agricultural methods are kept well in view in all work being carried out on experimental and demonstration stations, and in district work carried out by all officers. It is well known that the commitments of Nyasaland demand an increase in economic crops which must largely be grown by native cultivators, especially along the northern extension of the railways, but district work on such crops is always accompanied by efforts to improve the food crops by the issue of good seed and advice on better methods of cultivation. Such work also is concomitant with propaganda and demonstration in the maintenance of soil fertility in the cultivated lands.

It has been a matter of concern for many years that the diet of the native cultivator is very ill-balanced and that far too much reliance has been placed upon maize as the staple food. There is a distinct lack of protein, fats and certain vitamines in the food of the average native which are conducive to various deficiency diseases. Even in areas where a fair proportion of protein is

available in the form of fish, meat and milk it is apparent that numerous people, especially children, are very ill-nourished and that they receive a very ill-balanced diet over long periods.* Efforts are now being made by all officers to increase the cultivation of groundnuts and soya beans and this aspect of improving the diet of the native is to be kept well in view in coming years.

The close relationship which must exist between work on the improvement in the diet of the native, rotation cropping with leguminous plants, organic manuring and arrangements for minimising soil erosion has not perhaps been sufficiently stressed but travelling officers for the past fourteen years have kept such matters well in view. Locally-appointed supervisors have had their importance as well as the need of increasing and improving the production of economic crops impressed upon them and they have had much training under the Assistant Director and Agricultural Officers. This report might now go as far as to say that the large staff now employed by the Department and the Native Tobacco Board form an organisation whose first aim is the conservation of the soil, the greatest asset of Nyasaland, by all the means at the disposal of these men.

There is close liaison between the various bodies and officers who are concerned in experimental and demonstrational work. Close touch is maintained between the specialists of the Empire Cotton Growing Corporation and the Department in such matters as pure seed supplies, rotation cropping and grading. Where dark tobacco is the main cash crop the supervisors of the Native Tobacco Board are in constant touch with technical officers of the Department. The Assistant Director of Agriculture and Chemist is technical adviser to the Board and directs the experimental and tobacco seed selection work on the Zomba and Lilongwe stations so that continuity of aim and of policy is assured.

Further demonstration, experimentation and seed production is carried on at the Karonga, Port Herald and Domira Bay stations, the last-named being the headquarters of the Cotton Specialist of the Empire Cotton Growing Corporation who, as the chief cotton authority in Nyasaland, advises the Department primarily on seed supplies for the industry.

The principles of extension work as laid down in various treatises are closely followed by officers of the Department and the Native Tobacco Board but a reference may here be made to the development of small-holdings or family farms. It is well known that training of native community workers and their wives is carried on at the Jeanes Training Centre in such matters as hygiene, sanitation, child welfare, care of cattle and use of their products, and in all agricultural and forestry methods of proved value. Many of these workers will eventually create model small-holdings but their number for many years to come must necessarily be limited.

It is maintained that the establishment of a permanent agriculture and sound economic progress in most districts are only possible when such small-holdings are to be found in large numbers. Particular reference may be made to the northern districts where it is very difficult to find employment for many natives and it is uncertain whether certain economic crops will be successful. It may be many decades before many natives are induced to form family-farm groups. It must be remembered that there are no demonstration or experimental farms in four large and important northern districts and it is very necessary to provide demonstration to the people concerned of all agricultural work dealing with improvements in method or the introduction and cultivation of new plants. A start has been made with the institution of model small-holdings on the Lilongwe Station, the owners being quite independent but under the direction of the officer in charge as regards seed, cultivation, and rotations. Small-holders also in the vicinity of Zomba who have been established for some years on leasehold and their own freehold land are also under careful supervision.

Reference may here be made to the large imports of foodstuffs into Nyasaland in 1936. Much of these might be produced locally.

The following may be mentioned:—

| | Quantity | Value £ |
|---|---|---|
| All grain and flour ... ... | 3,858 cwt. ... | 2,103 |
| Sugar ... ... | 14,206 cwt. ... | 6,104 |
| Butter, cheese and fats ... ... | 285 cwt. ... | 996 |
| Ghee ... ... | 2,017 lb. ... | 124 |
| Milk, condensed and preserved ... | 93 cwt. ... | 316 |
| Provisions, other, including coffee, and cocoa | 2,272 cwt. ... | 7,736 |

* See also Agricultural Survey of Central Nyasaland, 1933.

It seems also that there is an opening for European agriculturists to produce certain of these commodities. The department certainly can and does advise on such agricultural production and is enabled to do so as a result of experience in the field and laboratory. Officers have helped lately in such matters as the development of a tung oil industry, increased production of soya beans, citrus culture, etc., but it seems that outside the large plantation industries there are now few settlers who can occupy themselves with a sound and diversified agriculture. It is obvious that the general agriculturist in Nyasaland is becoming middle-aged and is largely engaged in the purchasing of commodities grown by natives.

## Part II.—Work of the Department of Agriculture, the Empire Cotton Growing Corporation and the Native Tobacco Board.

### Experimental Stations.

*Port Herald.*—Work on this station and experience of the cotton crop in this oldest and largest producing area has somewhat revolutionised ideas on the correct time of planting and on the need of an adequate close season. It is absolutely essential that a long period should elapse between the up-rooting of one year's crop and the planting of the next year's. Furthermore the up-rooting should be rigorously enforced everywhere. If then the optimum time of planting commences in mid-January, all cotton bushes of the previous season should have been completely removed and burnt by November 15. Further work on the station dealt with many aspects of the cultivation of groundnuts and other leguminous crops, sorghum, millets and various mixed croppings. Very interesting results have been obtained in the control of rosette disease from the point of view of planting dates and spacing. The value of early planting and closer spacing has been amply demonstrated.

Inter-cropping of cotton with a short-age bulrush millet such as the Transvaal variety can be looked upon as a good combination. Inter-cropping of cotton with sorghums cannot be recommended.

Good rotation crops are pigeon pea and green gram. Lima, tepary beans and soya beans are not promising.

Details of the above work will be found in Appendix D.

*Makwapala*—The Makwapala Experimental Station is run by the Agricultural Officer, Zomba. His report on the station is to be found in Appendix E.

It is evident that the station has completed its usefulness from the point of view of many experiments and demonstrations. Work on the station in future will deal with soil improvement, animal husbandry, production of seed of improved strains of certain crops such as groundnuts and aspects of certain special crops such as citrus and sugar cane varieties. It will be run as a sub-station of Zomba Experimental Station and the Agricultural Officer concerned will be enabled to devote much more time to extension work among native cultivators.

*Zomba*—This Experimental Station has since its inception in 1926 been financed by the Native Tobacco Board and it is proposed to issue in the near future a full report on the work on soil conservation, animal husbandry, food crops, dark tobacco, rotations, etc. carried on during the past ten years. Re-planning took place during the year and a short report on various activities will be found in Appendix G.

*Lilongwe*—This Experimental Station is also financed by the Native Tobacco Board. During 1936 it was under the charge of Mr R. E. Jackson. The experimental demonstration and extension work here and in the district is carried on in close collaboration with the Assistant Director and with Capt R. M. Antill, now Agent and Senior Supervisor. The future inter-dependence of a sound dark tobacco industry and a well-conducted cattle industry have been recognised for some time and co-operative work in the field between the Veterinary Officer and the officers above was arranged during the year. Details of the experimental work and of the station itself will be found in Appendix F.

*Mlanje*—This Experimental Station is in charge of the Plant Pathologist. The conditions of soil and climate are typical of most areas of Mlanje and much valuable work on all aspects of tea culture is being carried out. Details are contained in Appendix B.

*Nkwali, Domira Bay* (*Empire Cotton Growing Corporation*)—The report of the officers of the Corporation is given in Appendix H.

A very broad view of the needs of the cotton industry had been kept in view in all the useful work carried out. Soils, rotations, food crops, as well as various strains of cotton for the varied elevations and conditions of the cotton zones have all received their due attention and the vast importance of the pest problem in Nyasaland has been well recognized.

## District Work.

An outline of the extension work of the department and of the staff of the Native Tobacco Board has already been given under a previous heading.

The manufacture of Indore compost has proceeded on a large scale in the Zomba and Chiradzulo areas with the object of maintaining fertility of gardens growing food crops and tobacco. It may be mentioned that careful supervision is required with the process of manufacture and that there is no easy road to a satisfactory product. Similarly when land is to be provided with works to minimise soil washing careful laying-out is necessary. The great value of the broad base Mangum ridge-terrace as advocated by the department since 1923 has been proved in all districts particularly those areas where supervision and assistance is given by the Native Tobacco Board and its officers. It should be pointed out however that when it is attempted adequately to protect a large block of land from abnormal soil erosion, the cultivators concerned require very careful supervision in the construction of various works and in contour cropping. Their interest must be aroused and it is better to prove to them the value of such works by small demonstrations rather than to rush a community into an extended scheme where inefficiency in construction at some critical point may destroy their confidence in such improved agricultural methods for years.

It may however be mentioned in connection with soil conservation and the possibility of growing food crops for many years, if not indefinitely ; on certain soils such as those of the Zomba series that certain large blocks of land round the villages of progressive native authorities have been adequately protected with various works. It may further be pointed out that careful work with a dumpy level is necessary before efficient terraces can be constructed.

Such terracing has been well carried out by Messrs. Bartlett and Smithyman and the following extract from the Annual Report of the District Commissioner, Chiradzulu is of interest.

"The 1935 report commented on the start of this work, which was begun mainly in Native Authority Mpama's area. The experiment there was not successful due partly to inaccuracy in the alignment of terraces and partly to the lethargy of the natives themselves. During 1936 the work was concentrated in N.A. Kadewere's area, where the keenness of the Native Authority offered some hope that the work would be properly done. Mr. Bartlett, the Tobacco Supervisor, did extremely good work in superintending and actively helping in the undertaking.

Again, numbers of natives have been induced to prepare compost for use in their gardens. 104 natives have made compost by the Indore method, 532 have made heaps for rain-watered compost, and 1,079 have applied compost to their fields. If the gardens so treated show the benefit of it in the 1937 crops, the manufacture and use of compost will spread further."

In the Lilongwe district, 3,983 acres of gardens have been provided with ridge terraces. The co-operation with the Veterinary Officer in the improvement of small-holdings, and in much more organic manuring has been mentioned.

Demonstration plots have been established particularly in the Nsaru and Lombadzi areas under Messrs. Scott and Wilbraham respectively. These are intended to show the values of rotation and manuring.

The areas in charge of all Agricultural Officers were well attended to as regards soil conservation, compost manufacture and seed issues. They are assisted by two agricultural supervisors in cotton areas along the Northern Extension, four supervisors of the Native Tobacco Board in central areas and eastern Mlanje and two supervisors in Lower River areas.

The supervisors of the Native Tobacco Board in Zomba, Chiradzulu and western Mlanje were concerned in co-operation with the Assistant Director of Agriculture in the production of some special types of dark tobacco. In Zomba, a type which has found favour on certain markets in the West African dependencies was aimed at in quantity and although only partial success was obtained, much experience was gained. A Central Buying Station with all its advantages was provided for marketing the crop. The tobacco receives special treatment according to a certain formula and this has been quite successful.

During 1936, fifty-five well sites were selected in Dedza and Ncheu by Mr. Kettlewell, the Agricultural Officer, Dowa, in conjunction with the administration. Areas with good soil were selected so that population may be better distributed and better food crops and more economic crops produced.

Three bore holes were also provided at Likuni, Chimvua and Nsaru.

Major D. N. Smalley was posted to North Nyasa as Agricultural Supervisor in October and at the time of writing district agricultural work has progressed satisfactorily with an extension of cotton growing. There are obviously two main zones for cotton in North Nyasa distinguished by different soils, different vegetation and in the average year a large difference in rainfall. The organisation of the cotton industry in these two zones must obviously proceed on different lines especially in such aspects as the type giving the best yield and quality and the length of a dead season necessary for the proper control of diseases and pests.

Organisation of the sale of foodstuffs such as rice and various commodities for the Tanganyika market resulted in much better grading of the former and fair prices generally.

The work of the native agricultural instructors who have been left without the supervision of agricultural officers for so long has been commendable in all directions.

The native coffee industry in the southern wet areas of the Cholo hills was supervised by the Assistant Director and Mr. A. B. Cormack. The first crop harvested during 1936 was of very good quality and fetched good prices. So far the bushes look very healthy and have kept remarkably free from pests and diseases.

## Soil Science and Chemistry.

The Assistant Director and Chemist was on leave for the latter half of the year and his work while being largely of an administrative nature also included work on soil science in collaboration with the Assistant Chemist and field workers of the Department and the Native Tobacco Board.

The usual amount of field work accompanied by the examination of profiles and mapping to show distribution of soil groups and series was carried out during the year by the specialist officers concerned. Laboratory work on soils included a special study of the reaction of chromic acid and sulphuric acid at various concentrations and temperatures, with a view to accounting for the discrepancies found in different rapid methods for estimating the organic matter in soil. Experiments on these lines carried out by the Assistant Chemist gave results of very considerable interest. The analyses of clay fractions from various soil types were continued and attention has been paid to methods for separating clay fractions. Dr. Black has devised a standard method for separation which is comparatively simple and satisfactory.

The work on the problem of the poor fermentation of tea grown in the high rainfall belt of Mlanje was continued on similar lines to that initiated in 1935. The good results obtained by the application of copper sulphate in dilute solution by means of spraying in the field were confirmed.

Laboratory work to explain the precise mechanism of the copper effect is being carried out by the Assistant Chemist in collaboration with the Plant Pathologist. The latter was on leave for eight months and experimental work at Mlanje was carried out during this period by the former officer.

The ordinary routine chemical work was carried out during the year. Advice was given on fertilizer treatments and analyses were made of different commercial fertilizers.

The usual tests for arsenic were carried out in suspected cases of dip-poisoning in cattle and deci-normal iodine was prepared for the Veterinary Department. During his stay in Mlanje it was found impracticable by the Assistant Chemist actually to make up the considerable volumes of the iodine solution required; but samples prepared by the Veterinary Department, were sent for analysis as a check on the strength.

## Entomology and Plant Pathology.

Details of plant pest and disease work are given in Appendices A and B. Particular attention may be drawn to the report on cotton pests and to the work on *Armillaria* root disease.

## Botanic Gardens and Plant Introduction Station, Zomba.

Introduced varieties of sugar cane, sweet potato, and pyrethrum which have formed medium scale plantings have now reached the stage where they can be issued to Experimental Stations. Large scale trials of the sugar cane varieties will be made in the near future at Makwapala for yield and sugar content.

Few introductions were made during the year but the species of grasses introduced in 1935 on the Zomba station were multiplied and planted on large fields in the new grazing area of 500 acres for proper trial under greatly varying conditions.

## Publications.

Bulletin No. 14, "Tea Seed Management," by R. Leach, Plant Pathologist, was issued during the year.

## Staff.

The Assistant Director of Agriculture and Chemist, Messrs. E. Lawrence and F. Barker, Agricultural Officers and Mr. J. A. Gray, Junior Clerk were on leave from the Department of Agriculture during the year under review. Of the Native Tobacco Board staff, Capt. R. M. Antill, M.C., and Messrs. R. E. Willbraham and J. W. Guise were on leave.

## Statistics.

Statistics relating to European and Native agriculture and livestock are given in Appendix I.

## Native Tobacco Board.

The members of the board were the Honourable the Treasurer, the Assistant Director of Agriculture, the Provincial Commissioner, Northern Province, the Hon. Mr. W. Tait-Bowie, O.B.E. Mr A. F. Barron, O.B.E., and the Director of Agriculture (chairman); during the absence on leave of the Assistant Director of Agriculture the acting Provincial Commissioner, Southern Province, was appointed a member of the board. The principal matters before the board were the publication of prices paid to growers, the re-organisation of the European staff consequent upon the resignation of Mr. W. P. Tylor, Agent and Senior Supervisor, the increase of staff, the housing of the staff, the granting of financial assistance to the Chief Conservator of Forests for the development and future management of village forest areas in the tobacco-growing areas, the production and issue and/or sale of tobacco plants to native tobacco growers in the Zomba and Upper Shire districts, the marketing of native tobacco generally, the marketing of Native Trust Land tobacco grown in the Kota Kota district, the control of the production of tobacco by natives on Native Trust Lands, the trading conditions at the central buying stations.

## Acknowledgements.

The work of the Department of Agriculture and the Native Tobacco Board has been assisted in generous manner by the British Cotton Growing Association, the Empire Cotton Growing Corporation, the Nyasaland Tobacco Exporters' Association, the Nyasaland Tea Association, the officers of the administration and by numerous individual agriculturists and commercial authorities, and thanks are extended to all concerned.

## PART III—Financial Statements.

The following statement shows the 1936 expenditure and receipts of the Department of Agriculture, The Native Tobacco Board statement is in appendix J.

*Expenditure.*

| | Approved estimate (including supplementary estimate) | Amount spent |
|---|---|---|
| PERSONAL EMOLUMENTS. | £ | £ s. d. |
| European staff ... ... ... | 9,915 | 9,388 8 6 |
| Native staff ... ... ... ... | 898 | 759 12 3 |
| OTHER CHARGES. | | |
| Transport ... ... ... ... | 1,438 | 1,352 17 2 |
| Travelling ... ... ... .. | 13 | 22 6 9 |
| Passages ... ... ... ... | 1,262 | 932 8 3 |
| Experimental Work ... ... ... | 1,026 | 895 2 2 |
| Distribution of Cotton Seed ... ... | 1,600 | 1,550 8 7 |
| Botanic Gardens ... ... ... | 45 | 43 17 10 |
| Contribution to Agricultural Show ... | 120 | 120 0 0 |
| Treatment of Plant Diseases ... ... | 150 | 78 0 8 |
| Library ... ... ... ... | 50 | 49 0 4 |
| Tools and Equipment ... ... ... | 200 | 158 14 4 |
| Seeds and Plants ... ... ... | 50 | 29 17 4 |
| Incidentals ... ... ... ... | 20 | 13 13 10 |
| Uniforms ... ... ... ... | 86 | 75 7 0 |
| Native Cotton Industry Contribution towards Upkeep of Experimental Station, (E.C.G.C.) ... ... | 325 | 325 0 0 |
| Transport (E.C.G.C.) ... ... ... | 300 | 340 0 0 |
| Contribution to Native Agricultural Board Native Coffee Cultivation ... ... | — | 6 0 0 |
| Courses of instruction for Agricultural Officers | — | 4 4 0 |
| Cotton seed stores and markets ... ... | 80 | 44 16 8 |
| Cotton seed bags ... ... ... | 200 | 141 11 9 |
| Upkeep of Boat ... ... ... | 30 | 24 1 5 |
| | 17,808 | 16,355 8 10 |
| SPECIAL EXPENDITURE. | | |
| Anti-Locust Campaign ... ... | 450 | — |
| Development of Export Crops Five Tents ... ... ... ... | 229 | 233 3 7 |
| Purchase of Boats ... ... ... | — | 9 18 9 |
| | 679 | 243 2 4 |
| | 18,487 | 16,598 11 2 |

| *Revenue* | £ | £ s. d. |
|---|---|---|
| Sale of Agricultural Produce ... ... | 140 | 96 10 4 |

## PART IV. SUMMARY OF LEGISLATIVE CHANGES AFFECTING AGRICULTURAL INDUSTRIES DURING 1936.

The Cotton Ordinance, No. 16 of 1934, was amended to limit the number of agents purchasing raw cotton on any one market and to postpone the date on which applications for registration should be received by District Commissioners. Amendments were made also in reducing the period for which licences to purchase are valid, and in various details affecting licence holders in their operations on markets.

The Director of Agriculture is given by other amendments and rules made in 1936 extended powers to limit the periods during which purchases of raw cotton may be made and to regulate and control other matters affecting the industry, especially in the better conduct of markets.

An ordinance was enacted in early 1936 to provide for the control of the marketing of flue-cured tobacco and for the creation of a pool. Unfortunately nothing could be done during 1936 to create a pool of representative types and grades of good Nyasaland brights in order that this tobacco might be marketed in the United Kingdom with the object of re-establishing such types and grades. It is proposed however in future years to create such a pool which will be operated by the Tobacco Control Board whose chairman is the Director of Agriculture.

An ordinance was enacted in 1936 to make provision for the eradication of noxious weeds. Such ordinances are of value in closely-settled countries but it seems that in Nyasaland the eradication of certain weeds must largely remain an ideal and that it will be some time before this enabling bill belongs to the realm of practical politics in most parts of the country.

The Tea Cess Ordinance which provided for the collection of a cess on exported tea was amended to allow for a higher rate being levied. The proceeds of the cess shall be used exclusively for the benefit of the tea industry and the Nyasaland Tea Association with the approval of Government prescribed that from January 1, 1937, the cess shall be paid at the rate of tenpence per hundred pounds.

A. J. W. HORNBY,
Acting Director of Agriculture.

# Report of the Entomologist.

I was acting as Assistant Director from June until the end of the year.

During June and the first week of July, I accompanied Mr. E. O. Pearson of the E.C.G.C. (Barberton station) on a tour of the cotton areas in the Chikwawa section of the Lower River, the Shire Highlands, the Angoniland Plateau and the Lake shore areas of the Dowa and South Nyasa districts. Lack of time prohibited North Nyasa being included and, unfortunately, exceptionally bad weather in July prevented the visit planned to the Port Herald area. This period was mainly concerned with the problem of cotton stainers and a great deal of valuable information was obtained during Mr. Pearson's visit and still more from his excellent report.

Early in November inspection of a suggested new cotton growing area near Bana on the Lake shore in the north of the Kota-Kota district was made in company with Mr. H. C. Ducker of the E.C.G.C. and the agricultural officer, Mr. R. W. Kettlewell. From the point of view of existing vegetation types, soil and probable rainfall the area was not considered to be a very promising one for any large extension of cotton growing.

This journey was followed by a short inspection of the native grown coffee and the department's station in the Nchena-chena area of the Mombera district and a reputedly possible cotton growing centre in the vicinity of Native Authority Chikulamaembe's headquarters in the same district. In the former case the impression was obtained that no extensive native coffee growing industry was an economic possibility under the existing conditions, and that even as a 'pocket-money' producing concern for a limited number of natives, continual regeneration of the gardens every five to seven years by the issue of fresh plants would be essential. Apart from the circumscribed nature of the cotton area, it is likely that the conditions of rainfall would make a successful cotton crop here something of an annual speculation. Separate reports were rendered on all the above three journeys.

## Crop Pests.

*Tobacco.* Investigation into the possible use of a dilute solution of iodine to eliminate root eelworm (*Heterodera marioni*, Goodey.) from tobacco seed-beds was undertaken. Preliminary work proved that solutions as weak as 1 in 4,000 rapidly killed active eelworms in shallow soil cultures and that tobacco seed germinated normally on such treated soil. An attempt, however, to adapt the treatment to seed-beds in a practical manner by substituting iodine solution for plain water in one weekly watering, a fortnight or three weeks after the seed had germinated, was, unfortunately, a complete failure. The plants were entirely killed within a few days by one watering with a 1 in 2,000 iodine solution, though seed resown on the same bed almost immediatly afterwards germinated normally but made little growth. Solution as dilute as 1 in 8,000 inhibited growth and caused some deaths. The possibility of pre-treatment of seed-beds is being considered but it seems doubtful if such treatment would prevent development of eelworm some nine to ten weeks later.

*Cotton.* Apart from the consideration of the stainer problem in conjunction with Mr. E. O. Pearson, as mentioned above, the comparative failure of the cotton crop throughout the country and in the Lower River districts in particular brought the subject of cotton pests into considerable prominence. While it must be admitted that the climatic conditions of the season were inclined to be unfavourable for the growth of the cotton plant and the development of flowers and bolls, it seemed highly probable that the poor crop could not be due solely to these factors. At Port Herald, for example, although the mean maximum temperature each month from March to May and from July onwards was slightly lower than in 1935, the mean monthly minimum temperature was always slightly higher and the average monthly temperature was a few degrees higher during nearly the whole season. On the other hand the relative humidity was some ten per cent. higher than during the past three years, being between 75% and 83% from January to July inclusive. To what extent, if any, such conditions would influence the abundance of cotton pests, or the spread and rapid development of the fungoid and bacterial diseases transmitted by sucking insects, such as stainers, it is scarcely possible to say in the light of our present knowledge, but that stainer damage was more severe in 1936 than in the immediately previous few seasons, which could be characterised as "dry" years, cannot be denied.

Stainers.—Of 400 bolls picked at random from various situations in the Lower River districts and examined in August, approximately 30 per cent. could be classified as healthy, 11 per cent. attacked by bollworm, 15 per cent. damaged by causes unknown or unidentifiable, and no less than 42 per cent. severely damaged by stainers.

The problem of cotton stainers and cotton bollworms is so intimately bound up with every aspect of the cultivation of the crop that successful results can only be expected from a whole time study of these insects. In the case of stainers the periodic migration of the adults from their various wild host plants is a subject that has, as yet, only been partially elucidated. This in itself is quite a large subject, depending as it does on the species of stainer concerned and the varying climatic conditions affecting the growth of the various host plants during the year. By means of a questionnaire sent to all agricultural officers and supervisors during the year, it is hoped that a certain amount of information may gradually be obtained as to the annual habits of some of the known local host plants in different types of country and at different elevations.

Bollworm.—The control of cotton bollworms is as yet, and in the writer's opinion is likely always to remain so, purely a matter of field husbandry. This implies selecting the most suitable type of seed for the conditions under which the plant will grow, adopting the most desirable planting date to give the plant the best possible conditions during growth and the ruthless destruction of all plants after a certain period so that there is an absolute *dead season* of at least two months between crop and crop. The mere uprooting of the previous year's cotton bushes when the new crop is already sown and possibly well advanced is quite useless, as a method of pest control.

A difficulty that occurs in an area such as the Lower River district in regulating an efficient *dead season*, is that a multiplicity of planting dates are possible owing to the juxtaposition of normal and river-flood lands, making it possible for cotton in all stages of growth to be in existence throughout the whole year. Certain advantages to be obtained from early planting on non-flood lands while harvesting on the flood lands has been prolonged, have between them created a situation in the Lower River districts whereby an efficient *dead season* has been rendered a practical impossibility. A natural, but unfortunate, desire for "record" crops year after year has produced just those conditions which most favour the serious insect pests of cotton.

A determined effort has been made this year (1936-37) to ensure that a *dead season* of at least six weeks shall be maintained. It is the writer's considered opinion, however, that this period *must* in future be increased to a full two months and be thoroughly enforced each season, if cotton pest infestation of the Lower River crop is to be kept within reasonable bounds.

In view of the variable planting dates possible, and hitherto adopted, in this valuable and well established cotton area of the Protectorate, it may become necessary for measures to be taken to prevent the planting of the new crop, each year, before a certain time in addition to the stipulation of the date by which the old crop should be uprooted. These remarks will apply equally well to cotton growing in the Lake shore belt of North Nyasa as that area develops.

The most satisfactory period for this *dead season* in the Lower River districts should, in the writer's opinion, include a portion of the first rains. It is probable that the majority of the bollworm moths hatch with the first showers, particularly the Red Bollworm (*Diparopsis castanea*, Hmps.). As this bollworm appears to have extremely few wild host plants (unknown as yet in Nyasaland) the absence of cotton plants on which this first brood of moths could oviposit should offer a considerable check to an early rise in numbers of bollworm and hence the future broods.

A further point in the development of cotton growing in any new areas is that all Kidney-cotton plants must be eradicated, whether the tribes concerned wish to retain them for the use of the lint for certain ceremonial purposes or not. In both the areas visited in the Kota-Kota and Mombera districts, mentioned above, plants of this perennial cotton were found in villages and in one case Red Bollworm was flourishing on it.

Leaf-rollers and other caterpillars.—In addition to severe attack by stainers, other cotton pests were more prominent than in recent years. Damage by the leaf-roller, *Sylepta derogata*, F., was noticeable early in the season in nearly all districts, and the defoliating caterpillars *Cosmophila erosa*, Hubn., and *Acontia graellsii*, Feisth., were particularly numerous in the Lower River areas. A Braconid, *Disophrys* sp., was found to be parasitizing the latter.

Stem-borer.—The topping of cotton plants by the Lamiid beetle, *Tragischoschema wahlbergi*, Fhs., and stem boring by its larvae was of common occurrence. Such damage is usually most severe in the vicinity of Sterculia trees or Dombeya plants, which appear to be alternative hosts.

Scale.—A considerable infection by a species of *Pseudococcus* occurred in the Domira Bay area, but did not appear to do a great deal of damage.

Termites.—Damage by white ants was severe in some parts of the South Nyasa district.

*Cereals.* A severe out-break of swarming caterpillars, *Laphygma exempta*, Wlk., occurred in April throughout the southern half of the country. Fortunately, maize was generally large enough by that time to escape serious damage but late sown oats, wheat and barley suffered severely as also did all pasture and wild grasses. On the Zomba Experimental Station continual spraying was necessary to save a portion of the above crops. It was found that double strength Katakilla was successful on very small caterpillers, but later only those under half-an-inch in length were killed. Similarly, double strength Pysect was only effective on the small larvae. Tobacco Extract at 1 in 20 with spreader had no effect on those more than half grown. Normal strength Paris Green was found to be most rapidly effective, though producing some scorching of the plants. By April 20th parasitism, mainly by a chalcid of the *Miscogasteridae*, was severe on the smaller caterpillars and an *Empusa* fungus, much obscured by a *Penicillium*, developed into a controlling factor. A Ceratopogonid fly (? *Formicopyia* sp.) was frequently found feeding on the smaller, healthy caterpillars.

The beetle, *Epicauta velata*, Gerst., did severe damage to all maize and millet flowers in the Lower Shire district. The prevalence of this beetle may have some connection with the locust invasion in that its larvae probably are predaceous on locust eggs.

*Pulses.* At the Port Herald Experimental Station larvae of the Noctuid moths, *Anticarsia irrorata*, F., and *Amyna octo*, Guen., defoliated Vigna beans and the Pentatomid, *Brachyplatys testudo-nigra*, de Geer., seriously damaged Dolichos. These Noctuid larvae are also cotton pests but *A. octo* has not been recorded as serious since 1915.

Soya beans at Zomba were severely attacked by an Agromyzid fly, the larvae burrowing into the stems at ground level. A Braconid, a Chalcid and a Cynipid were all bred from the same material.

In April, tea mosquito bug, *Helopeltis bergrothi*, Reut., was found breeding on *Cajanus indicus* at the Zomba Experimental Station. Although this plant has long been known as a host plant of this insect, the interesting observation was made that eggs were being laid in the main stems just above ground level and apparently not at all in the young, upper shoots. It appeared that at this position the bark was thick enough for the eggs to be buried in it alone, the hard wood not being penetrated. In the upper shoots the bark is only a very thin covering over the hard wood, insufficient for an egg to be imbedded in it, and presumably the woody centre of the shoot cannot be penetrated by the ovipositor. Consequently rattooned *C. indicus* plants can act as a reservoir for tea mosquito bug.

*Sesamum.* The foliage of this crop at Port Herald was attacked during January by the Halticid beetle *Aphthona bimaculata*, Jac., a new pest record.

*Tung Nut.* The scale insect, *Icerya purchasi*, Mask., was recorded from a plantation in the Cholo district. It is probable that the lady-bird beetle *Novius obscurus*, Wse., exercises a natural control of this pest.

A more serious outbreak of scale occurred on two small areas on the trees (*Aleurites montana*) in the Zomba Experimental Station. The scales concerned here were *Aspidiotus hederae*, Vall., *A. rapax*, Comst., and *A. lataniae*, Sign., with the former predominating. These scale insects are all common and widespread throughout the country and have a large number of host plants including *Sesbania* and *Melia*. The infection of these tung trees was confined to two places in which it appeared that root development might have been impeded by a stony soil, but the trees had made perfectly normal growth hitherto and borne good crops of nuts. Parasitism by Chalcids was heavy but the infection was not checked. Leaf fall in the dormant period was much delayed in the cases of the attacked trees. No control measures were employed as it was desired to observe whether the infection would spread, or be naturally checked by the dormant period. The infestation was considerably heavier than in 1935, but the increase during the year 1936 did not appear to be very great though there were indications that it was taking place.

*Tea.* With the exception of Red Spider and Mosquito Bug this plantation crop remains very free from pests. A few bushes at Mlanje were found to be carrying the scale insect *Aspidiotus sylvaticus*, Ldgr., and a Thrips (not yet identified)* was found in some numbers on somewhat unhealthy Indian jat bushes on one estate in Cholo. Both these are new records of tea insects.

**Heliothrips haemorrhoidalis*, Bch.

Red Spider attack has been exceptionally heavy for some years now, but it is gratifying to record that several estates are now employing definite spraying campaigns, using lime-sulphur or sulphur preparations. The colloidal sulphur, Sulsol, with the addition of soft soap for preference, has been proved to be very effective and if a double spraying at a ten-day interval is properly applied there is no reason why this pest should not be reduced to normal proportions. The higher cost of this material over home-made lime-sulphur is offset by its simplicity of preparation and greater effectiveness. A sufficiency of machines is an essential factor in the successful control of Red Spider.

*Groundnuts.* Rosette disease transmitted by *Aphis leguminosae*, Theo., was serious in many districts and the crop was largely a failure. An *Aspidoproctus* scale was recorded from plants at the E.C.G.C. station at Nkwale.

## LOCUSTS.

The red-winged locust, *Nomadacris septemfasciata*, Serv., was the only species occurring in the Protectorate during the year. The development of adults of the 10th generation was, generally, on a less intense scale than in previous years. The scattered, quiescent nature of the hopper bands in some areas was again noticeable, and in the Domira Bay area *dissocians* phase habits were conspicuous in the small resulting swarms.

A prolonged hopper period and late developing hopper bands were also recorded, though in the Lower Shire and Chikwawa districts a fairly normal developmental period was, once again, a feature of these districts.

The first flying swarms of the 10th generation developed in March and by April most hopper bands had reached the adult stage. Vacation of the lower levels by these swarms occurred as usual, but dull weather with high humidity during the middle of the year appeared to check any concentrated flights, and a very irregular circling movement in the Shire Highlands as a whole continued for the main part of the year. It was not until well on into December that a definite north and north-west movement set in, and it was then observed that there appeared to be a heavier infestation in the Protectorate than previous evidence had indicated. Some of these swarms penetrated districts of the Northern Province, Dowa and Kota-Kota, which had been free nearly the whole year. Except for an occasional swarm entering from Northern Rhodesia, however, the three most northern districts, North Nyasa, Mombera and Kasungu, have not been invaded this year.

Damage done, both by hopper bands and adult swarms, was considerably less than in previous years.

*Egg-laying, 11th generation.*—Breeding colouration did not appear in the swarms until November, and the first egg-laying occurred on about December 14th in the Lower River districts and in the Shire Highlands, this being nearly a month later than in the previous year.

There is no doubt that re-invasion of the Protectorate by swarms from the Zambesi valley and territory to the south and south-west occurred on some scale towards the end of the year, creating a situation less favourable than had been anticipated.

The phenomenon of the prolonged hopper periods was carefully studied and a comparison of the temperature and humidity factors over a series of four years at several stations showed that most rapid and intense development occurred at temperatures above 85°F. and at humidities below 80 per cent. It was also found that the Lower River districts, alone, had experienced conditions most nearly approaching the optimum for hopper development in all four seasons. In most of the other parts of the Protectorate where hopper development occurred there was a general tendency during the critical months for a fall in temperature and a rise in humidity away from the most favourable conditions each year after the initial locust invasion in 1932-33. It may be anticipated therefore that only under hot and dry conditions will hopper bands become a serious danger.

This work has been written up as a technical paper that will be published elsewhere.

Early in the year it was found that isolated hoppers, having the yellow and green *solitaria* phase colouring, were inhabiting many of the large dambos in some of the Northern Province districts. Repeated investigations, however, indicated that most of, if not all, these hoppers failed to reach maturity as no hoppers older than the third instar were ever seen.

The Vwaza marsh area, near the Rhodesian border in the Mombera district (lat. 10° 50′ S.), was visited in January, as it was unknown whether this area might constitute a temporary breeding centre for this locust. It was found to be of such a swampy nature that it would not be a suitable breeding site.

The following predators of *Nomadacris* eggs and hoppers have been bred or collected:—

| | |
|---|---|
| *Chlaenius obesus*, Chd. (Carabidae.) ... ... ... | Larvae on eggs |
| *Mylabris dicincta*, Bert. (Meloidae.) ... ... ... | ,, ,, ,, |
| *M. pertinax*, Pèr. ( ,, ) ... ... ... | ,, ,, ,, |
| *Epicauta designata*, Pèr ( ,, ) ... ... ... | ,, ,, ,, |
| *Scelio howardi*, Cwf. (Scelionidae.) ... ... ... | On eggs. |
| *Stomatorhina lunata*, F. (Calliphoridae.) ... ... ... | ,, ,, ,, ,, |
| *Acanthoplus speiseri*, Brancs. (Tettigoniidae.) ... ... | On 3rd stage hoppers. |
| *Rhinocoris violentus*, Germ. (Reduviidae.) ... ... | On 1st stage hoppers. |

Two specimens of the tree locust, *Anacridium moestum*, Serv., have been collected from Port Herald.

ACKNOWLEDGEMENTS.

Thanks are due to the Imperial Institute of Entomology for the identification of 17 Coleoptera and 13 Acrididae.

COLIN SMEE,
Entomologist.

*Appendix B.*

# Report of the Plant Pathologist, Mlanje Experimental Station.

## 1. Tea Diseases.

*Armillaria Root Disease.*—One month old tea seedlings were infected successfully with *Armillaria* under experimental conditions, the roots of *Glyricidia* trees killed by the fungus being used as a source of infection. Infection was obtained only by contact of the seedling root with fresh rhizomorphs growing out from the *Glyricidia* root. Those seedling roots in contact only with the old black xylostroma in the bark and those growing into the wood rotted by the fungus were healthy.

Examination of the seedlings showed that after penetration the fungus travelled up and down the root as an internal rhizomorph the tip of which also advanced as a unit. Individual hyphae were observed to be growing out into the seedling tissue only behind the advancing tip of the rhizomorph. It was noticed that those individual hyphae developed towards the wood and pith but not in the cortex. The cortex was devoid of starch while the wood and pith contained starch. This seemed to suggest that *Armillaria* required tissues rich in carbohydrates for its successful development in roots.

Other fungi are known which are only capable of entry into living roots when the latter are weakened by some circumstance and are depleted of carbohydrates. These fungi, for example *Rhizoctonia bataticola* and *Botryodiplodia Theobromae*, are unable to parasitise the roots of healthy plants.

From a consideration of these points the following hypothesis has been framed for the biological control of *Armillaria* root disease. Forest trees when felled normally have their roots well supplied with carbohydrates and are thus in a suitable physiological condition for invasion by and the rapid development of *Armillaria* should they be of a susceptible species. If those roots could be depleted of carbohydrates *before* the forest is cleared then they should not be in a condition suitable for the development of *Armillaria* but should be killed instead by fungi of the *Rhizoctonia—Botryodiplodia* type which are considered to be common saprophytes in the soil. Ring-barking the trunk of trees close to the ground depletes the roots of carbohydrates. If this process was employed with the susceptible species of tree prior to opening up new land, the forest roots would then be killed by fungi innocuous to healthy tea plants in place of *Armillaria* which has been shown to be a primary parasite of that host. In this way the commonest source of infection by *Armillaria* would be removed.

This hypothesis was put to the test by examining the roots of "Muula" trees (*Parinarium mobola*) which are known to be very susceptible to invasion by *Armillaria* after being felled. Examination of 24 dead "Muula" stumps felled normally showed that 20 of them were invaded in almost every root by *Armillaria*. This fungus was absent from every root of the 12 "Muula" trees examined which had been killed by ringing. The roots of the latter were dry-rotted and the sclerotia of *R. bataticola* were always in evidence underneath the bark. The results of these examinations are so strikingly in accordance with the above hypothesis that consideration is being given to its application to estate conditions.

Tea seedling roots were shown to remain healthy when grown in contact with dry-rotted "Muula" roots.

## 2. Other Tea Work.

*Planting Experiment.*—The method of planting one and a half year old tea stumps (stems cut back to 4") has proved successful in some years but very disappointing in others. This has depended upon the onset of hot sunny weather which may occur characteristically during the rainy season for periods lasting up to three weeks.

The failure in planting has been considered until now to be due to lack of moisture in the soil during these hot spells. Observation showed that the soil moisture appeared adequate for root development six inches below the surface even during the fine weather. Examination of stumps showed that they are first affected by a ring of darkened bark at the collar indicating a

scorching at that region. The stem of the stump subsequently dies as a result of the ringing at the collar. Unless suitable weather ensues the root dies back from the collar leading eventually to death of the stump. If sufficient new root growth has taken place prior to scorching the stumps often sprout from below the ringed collar, i.e. from below ground level, the plants being able to check the dieback in the roots.

The supposition that scorching due to heating of the collar at ground level was the cause of the ringing (and thereby the cause of the planting trouble in Nyasaland) was put to the test in the experiment described below. To prevent the soil becoming heated at the collar an inverted, bottomless, 4″ planting pot (cut into two halves longitudinally) was used as a shade. This allowed the stem of the stump to stick out slightly above the top of the shade with the result that the young shoots were not drawn up by the shade. The two halves of the pot were placed close to the stump, east and west of it. The collar of the stump was thus shaded except at midday.

Thanks to the assistance of the Manager of Mini Mini Estate, Mlanje, in erecting the apparatus, it was found that a soil surface temperature of 130°F caused the collar of the stumps to be scorched. This temperature can only be regarded as a rough guide to the critical temperature under natural conditions. The critical temperature for scorching is undoubtedly affected by such factors as the humidity of the air, internal water relations in the stem and the original position of the plant in the nursery bed as this would affect the hardiness (cork development) of the bark on the stem. The critical temperature under natural conditions is probably about 140°F. Temperatures were taken inside and outside the pot shades. The following data is of interest in showing with what conditions stumps have to contend in Nyasaland and how shading affects the temperature at the collar.

*Daily Maximum Surface Soil Temperature.*

| Date. | Weather. | | Temperature °F | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dec. 13 to 19. | Showery and cool | UNSHADED | 119. | 98. | 89. | 95. | 109. | 107. | 78. |
| | | SHADED | 95. | 86. | 82. | 89. | 101. | 91. | 76. |
| Dec. 29 to Jan. 4 | Hot and sunny. | UNSHADED | 138. | 147. | 140. | 147. | 152. | 143. | |
| | | SHADED | 115. | 122. | 120. | 128. | 136. | 127. | |

*Hourly Surface Soil Temperature During Hot Spell (Jan. 2nd).*

| | Temperature °F | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 a.m. | 10 a.m. | 11 a.m. | Noon. | 1 p.m. | 2 p.m. | 3 p.m. |
| UNSHADED ... ... | 69 | 134 | 140 | 149 | 152 | 142 | 145 |
| SHADED ... ... | 71 | 101 | 122 | 136 | 123 | 116 | 115 |
| Difference ... ... | 2 | 33 | 18 | 13 | 29 | 26 | 30 |

The above tables give a good idea of the high temperatures to which unshaded stumps are subjected during the characteristic hot dry spells which occur during the planting season in most years. The second table shows the many hours in which unshaded stumps have to contend with these high temperatures during each day.

These temperatures were taken in Mlanje red soil. It is likely that the temperatures of the darker soils in the district rise even higher. The soils of the cooler district of Cholo are likely to heat up to the critical temperature owing to the more sandy nature of the soil there.

An experiment was carried out by planting every Monday for nine consecutive weeks, starting on December 2nd, 1935, irrespective of the weather so that the treatments should be subjected to all types of weather that occurred during that time. It was originally intended to run the experiment for 12 weeks as a minimum but from the experimental point of view the first nine weeks proved ideal for testing the hypothesis of scorching. The experiment was laid out in the form of a randomized block. Forty plants of each treatment being planted in four blocks each Monday. All plants except those of Treatment E were cut back to 4″

Experiments had shown that no new roots emerge from one and a half year old stumps until the ninth day after planting under optimum moisture conditions. A method was devised whereby the stumps were dug up one week prior to planting out and were packed close together with soil in shaded and watered pits (named below as "rooting pits"). In this way the new root initials developed while the plants were in the pits; the roots themselves emerge two or three days after planting out in the field instead of taking the normal nine days. Other treatments were given as shown below. Plants of every treatment were fertilized with ½-oz. of sulphate of ammonia in March, 1936.

*Treatments.*

A. Unshaded. No other treatment.
B. Unshaded. Roots mudded prior to planting.
C. Unshaded. Roots dipped in liquid kraal manure prior to planting.
D. Unshaded. One week in rooting pit.
E. Unshaded. Plants not cut back, leaves stripped off.
F. Shaded. No other treatment.
G. Shaded. One week in rooting pit.
H. Shaded. One week in rooting pit and then dipped in liquid kraal manure.

The following are the results of the experiment showing the effect of the weather on the ultimate stand of plants on December 31st, 1936, *i.e.* one year after planting. The weather effect is represented in the table by the following examples:—

I. Ideal planting weather followed by showery and cool weather (typical of a good planting season).

II. Ideal planting weather followed by a hot dry spell (typical of a bad planting season).

III. Planting in the middle of a long, hot, dry spell (December 30th) — (not likely to be tried on estates).

*Table. Percentage stand after one year.*

| | Treatments. | | | | | | | | Significant Difference. |
|---|---|---|---|---|---|---|---|---|---|
| | Unshaded | | | | | Shaded | | | |
| | A | B | C | D | E | F | G | H | |
| I. ... | 97.5 | 95.0 | 95.0 | 95.0 | 90.0 | 100.0 | 100.0 | 100.0 | 3.3 |
| II. ... | 42.5 | 52.5 | 42.5 | 55.0 | 47.5 | 100.0 | 97.5 | 97.5 | 27.0 |
| III. ... | 25.0 | 50.0 | 22.5 | 45.0 | 7.5 | 27.5 | 80.0 | 75.0 | 20.0 |

The outstanding feature of the experiment is the beneficial effect of shade on the ultimate stand under varying weather conditions typical of a difficult planting season.

Only in the abnormal conditions (III) did the shading fail (see Treatment F). This would appear to be the only case in which the effect of drought played a part because the shaded plants which had been in the rooting pit gave a remarkably fair stand considering the conditions (see temperature table for the planting date, *i.e.* December 30th). The rooting pits were of no benefit unless the plants were shaded.

Plants not cut back did no better than those cut back to 4." Mudding the roots or dipping them in liquid manure was of no value in obtaining a better stand under typical planting conditions.

The experiment shows clearly that if some form of shade can be employed to prevent the collar of the stumps becoming scorched by the hot surface soil a good standard of planting should be attainable in future, irrespective of the season. Evidence of this has already been recorded on some estates in Mlanje and Cholo where the shading of stumps was employed at the beginning of the year.

*Fermentation.*—A number of experiments were carried out on behalf of the Chemist and Assistant Chemist in connection with their investigation into the problem of poor fermentation of tea leaf from certain soils in the Mlanje district.

### 3. Other Diseases.

*Citrus. Exanthema.*—This disease was found for the first time in Nyasaland in January 1936. Some trees were badly affected and had started to die back. The symptoms of the disease seen in the affected orchard corresponded with the following description given by Fawcett in his book "Citrus Diseases and Their Control." Primary symptoms.—*Gum pockets.* The gum pockets develop at or near the leaf nodes in succulent branches before they have maintained full length. The bark is raised, giving the appearance of a large blister. Between the wood and the gum is a clear amber-coloured gum. *Bark excrescences.*—The bark excrescences are formed by longitudinal or rounded breaks through which gummous tissue is forced, resulting in a "double convex to rounded pad of crystal-like gum on the stem." These may form along the terminal stems mostly near the base, in the bark of the fruit spurs, or in the leaf axil among the buds. *Stained terminal branches.* A stain occurs on young succulent growth as a "brownish glossy, gum-soaked condition in only slightly raised spots and irregular areas".....In severe cases, these stained terminal twigs die back partly from invasion of secondary organisms, giving the common but inappropriate name, dieback, to the disease. Secondary symptoms.—*Deep-green colour of foliage.* Trees on the verge of exanthema and growing under favourable food and moisture conditions may show unusually large deep-green foliage, giving to the unpractised eye a very promising appearance. *S-shaped branches.* Branches which appear to be bent over by their own weight and start to grow up again, giving an S-shaped appearance, are frequently found in trees affected with exanthema.

Exanthema is not infectious; it is a physiological disease caused by a deficiency of copper (Haas & Quayle. *Hilgardia* 1935). Draining of the soil and spraying of affected trees with Bordeaux mixture were recommended as control measures. The disease was much less in evidence by the end of 1936. Bordeaux spraying is effective not as a fungicide but as a source of copper available for absorption in small quantities through the foliage.

*Citrus. Mottle Leaf.*—This disease is very common in Nyasaland. It is that described by Fawcett under the name of Foliocellosis as follows, "The leaves show chlorotic areas, irregular in outline, situated between the main lateral veins on each side of the midrib. The part immediately next to the large veins and midrib remains green, while the green matter is lacking in portions between these. This results in irregular spotting or mottling. In trees only slightly affected, this may occur on leaves of normal size and without much effect on the tree or crop. When more severe, however, the leaves mature smaller in size, and in the worst stages of the malady they are usually not only very small but extremely narrow as compared to healthy leaves."

Mottle-leaf has been shown to be due to a deficiency of zinc in the plant. In America and South Africa it is effectively controlled by spraying the foliage with zinc sulphate and lime. Spraying experiments in Nyasaland were carried out at the beginning of the year and have given encouraging results.

### 4. Work of Mlanje Experimental Station.

*Experiments.*—The experiments in progress on the plots of old tea on Ruo Estate were continued throughout the year and yields were recorded. As these experiments will have run for three successive years at the end of the 1936/37 crop it is intended to publish the results in the Annual Report for 1937.

Tea on the Mlanje experimental station has now reached the stage when plots can be laid out for yield experiments.

The Assistant Chemist took over charge of the station from April 6th until November 30th.

R. Leach,
Plant Pathologist.

# Report of the Agricultural Officer, Dowa.

*The weather.* Once again the rainfall distribution has been sufficiently abnormal to leave its mark upon native agriculture. The abnormalities took the unfortunate form of delayed and light planting rains, an extremely wet March and, as far as one can tell without standard recording instruments, very cold nights during the early months of the dry period.

The principal effect of this ill-distribution was the reverse of that experienced last year : maize was but little affected ; but cotton yields were sadly reduced.

The beginning of the 1936 rains has again been delayed, with no appreciable fall till the first week in December. Since them, however, rains have been adequate and gentle.

*Native food crops.* Maize. The year which began with a comparatively serious shortage of food, has ended in plenty in all but a few small areas of lower fertility on the Dowa and Dedza Lake shore. It is indeed fortunate that the badly distributed rainfall did not adversely affect the staple food crop for a second year in succession. In the early months of 1936 there was a certain amount of suffering in many areas ; and a constant stream of natives left the Lake-shore for the Dedza or Kota Kota hills, where a small surplus of food could be bought for cash or labour. Needless to say, this enforced absence resulted in the neglect both of food and cotton gardens—more particularly the latter. In these days when Lake-shore natives possess a certain amount of cash from the sale of cotton, they would readily buy food if it were offered locally in times of shortage. This year's experience has clearly demonstrated the effect which continued and distant search for food produces upon the economic crop. The latter is either not planted at all in many cases, or planting is seriously delayed. In future years of shortage it would be well, perhaps, to consider the provision of food for sale locally.

The 1936 maize crop suffered a little in the early stages from caterpillar attack ; but no damage was done to this, or any other, crop by locusts ; and the shortage began to be alleviated by the harvest of green maize in March. After the crop had ripened 60 tons of maize were bought in south Kota Kota for shipment to distressed areas elsewhere.

In spite of the almost certain prospect of further slight shortage on the Dowa Lake-plain, natives were easily persuaded to sell some of their new crop to local estates before the sale of their cotton had satisfied the longing for ready cash. Later further sale was checked by legislation on the part of certain native authorities ; but it would seem a wise precaution in the future for all native authorities to prohibit the sale of maize in lean years, until after the first cotton markets have provided cash and enabled the native to think more sanely of the state of his grain store.

Cassava. As usual, cassava was little affected by the vagaries of the weather, and the Kota Kota Lake-shore villages had enough food and to spare. Attempts were made by the District Commissioners, Dedza and Dowa, to import Chinteche cassava for the alleviation of hunger in their respective Lake-shore sections ; but the limited capacity and infrequent sailings of the *Guendolen*, and the breakdown of the *Malonda*, rendered the results of small account. What cassava there was, however, was readily bought. Other consignments were shipped by dhows and sold at prohibitive prices.

Pulses. On account of severe shortage of seed stocks all pulse crops are still somewhat scarce, and recovery is taking place but slowly. Much of this year's reduced harvest was carefully kept, and has now been planted out. This refers to groundnuts, in particular, and the acreage in hill gardens gives promise of a certain amount for sale.

*Future outlook.* Staple foods will be adequate generally, and the few areas in which shortage may occur will have little difficulty in satisfying their needs nearby. Recent rains have given the new crop a good start, and locusts have so far done little damage.

*Economic crops : Cotton.*

Seed issue and planting. The 1936 cotton crop has been a considerable disappointment, and the total yield has declined by nearly 800 tons from that of 1935. From the start conditions were against it : large numbers of potential growers were fully occupied in searching for food in the hills ; and the planting of those more fortunately situated was delayed by inadequate rain. An average earning of 25 shillings per cotton grower in the previous season had created considerable enthusiasm, and more than double the quantity of seed was issued to intending growers. The

influence of hunger and unkindly rains is reflected in the fact that more than 2,000 of the 15,000 who received seed failed to plant it at all. Moreover the time of planting was so delayed that only 34 per cent. of the crop had been planted by the end of 1935, as opposed to 47 per cent. in the previous season. 13 per cent. even delayed planting until February.

The number of growers and details of seed distribution are given in the following table:—

*Table 1. Number of growers and distribution of seed.*

| District. | No. of growers. | Seed issued. | Seed per head. |
|---|---|---|---|
| Kota Kota | 1,723 | 31 tons | 40.3 lb. |
| Dowa | 4,596 | 90 ,, | 43.9 ,, |
| Dedza | 6,334 | 137 ,, | 48.5 ,, |
| Ncheu | *3,005 | *59 ,, | *44.0 ,, |
| Total | 15,658 | 317 | 45.35 |

Germination was good and no trouble was experienced from locusts. The care of gardens was noticeably spasmodic in hungry areas; but generally speaking, growth and development proceeded well until hit by the excessive rains of March. Some idea of the rainfall may be obtained from the fact that it was the heaviest ever recorded for the month at Kota Kota. Unfortunately the full adverse effect of the heavy rain was felt by the earlier-planted cotton, thereby removing the last chance of even a moderate crop. Considerable boll development had by then taken place on the earlier cotton, and excessive rain at this critical period resulted in very heavy boll-shedding. At that time it was by no means uncommon to see whole gardens completely water-logged in the area between Salima and the Lake; and frequently there was scarcely a boll left on the plants. Under these conditons the January-planted cotton was showing to better advantage, since it had not then reached the critical stage of boll development. However the very fact of late planting precluded it from the chance of bearing a heavy crop.

Later on both boll-worm and stainer made an irregular appearance throughout the district, but nowhere in very great quantity, except for the heavy infestation of a few individual gardens in the Salima neighbourhood.

The advent of the dry weather was accompanied by unusually cold nights which persisted in the south half of the district until the first markets, which occupied most of the month of August. The circumstances already detailed above had so combined to delay ripening that the markets were held approximately three weeks later than last year. The markets this year were attended by an atmosphere of depression both amongst buyers and growers. The small crop disheartened both, and the natives were further upset by the demands made upon them to build markets which were sometimes sixteen acres in extent. This area was necessitated by the large number of buyers, all of whom had to be spaced at 100 ft. intervals for the purposes of fire insurance. Further discussion on the merits or demerits of the markets would be out of place here, since the whole matter is already being considered for necessary revision.

The first markets yielded a total of just over 858 long tons of cotton, of which 93 per cent. was classed as No. 1 and purchased at an average price of 1½d. per lb. The corresponding figures for last season were 1,276 tons, 93 per cent. of which was No. 1 and valued at 1½d. lb. Taking into account the demoralising effect of low yield, 93 per cent. of No. 1 cotton may be said to represent very thorough grading. Doubtless this was encouraged by the introduction of glass-covered grade-boxes exhibited at important points throughout the district. This assistance was much appreciated by the natives, and could profitably be extended in conjunction with the establishment of standard grades.

The second markets were also delayed in the hopes that a greater proportion of the crop would mature, but later ripening did not come up to expectations. The markets finally occupied the first half of October and were even more disappointing than those already held. The total amount of cotton bought was 126 long tons of which only 60 per cent. was classed as No. 1. The price of No. 1 was just under 1½d. per lb. The low percentage of No. 1 represents poor grading rather than a badly stained crop. The majority of growers had but a crate or two of cotton left; and, as was also the case last year, the value of grading in actual cash is not yet so fully realised as to encourage the efficient grading of small quantities.

* Includes figures for Agricultural Officer, Zomba.

The total amount of crown-land cotton bought during the year amounted to 984 long tons, of which over 85 per cent. was graded as No. 1. The output per grower of all grades of cotton is therefore about 170 lb. which, with an average garden size of .6-acre, amounts to a mean yield of 280 lb. per acre. The estimated yield per acre of the previous season was 500 lb. of which 88 per cent. was classed as No. 1. It will be noticed that in spite of the poor yield, quality, as expressed by the absence of discolouration and extraneous matter, was but little inferior to that of 1935. Needless to say the assessing of quality in this manner is a difficult task in the absence of standard grades; and perhaps it is unwise to attach too much importance to grade figures when making comparisons of quality from year to year.

The total amount of money paid out to crown-land natives in respect of cotton sold amounted to £12,440, or an average earning of 19s. 3d. per grower as compared with 25s. last year. It is very fortunate that this year's high price prevented a much more depressing return to the grower.

The figure which shows up to greatest disadvantage in comparison with last year is the factor expressing the return of seed cotton for seed issued. It amounted this year to but 3.2 as opposed to the high figure of 11.5 in 1935.

The uprooting date was postponed this year until October 15th—a fortnight later than last year but even so it was difficult to get the cotton plants destroyed without delay. A more active interest on the part of the district commissioners, through their native authorities, would be of great assistance in this matter.

Seed issues for 1937. By the close of the year seed issue was practically complete, and the total issue will be a little in excess of 300 tons, or approximately the same total as issued last year. The distribution is, however, different: the Yao sections of north Dedza and the Dowa Lake-shore are showing a certain disinterest in cotton believed to be mainly due to the Yao's dislike for agriculture and preference for such occupations as the fish trade, and partially also to the discouraging floods to which much of their land was subjected last March. Their decision to abandon cotton, at any rate temporarily, has resulted in a reduction of 20 per cent. in the seed issued in Dowa and north Dedza. This decrease is, however, balanced by an increased issue in south Dedza, Ncheu and Kota Kota. The foothill section of Kasakula in Kota Kota is planting extensively for the first time, as is also Kanyenda's section in north Kota Kota. Cotton growing has been sanctioned as an experiment in the latter area; but it is feared that little permanent success can be expected.

It is satisfactory to note that the importance of early planting is at last sinking into the native mind: and, although no figures are yet available, it is estimated that about 70 per cent. of the crop had been planted by the close of the year. Rain did not fall in any quantity till the 5th of December; but since that date growing conditions have been good and the crop may be said to have had a favourable start.

*Economic crops: Oil Seeds.*

Groundnuts.—The acreage of groundnuts harvested this year was very small indeed on account of negligible seed stocks the year before. Attempts were made by certain Europeans to purchase what crop there was in the Dedza hills this year; but the natives appear to have retained as much as possible for replanting. It is most unfortunate, from the buyer's point of view, that so little was offered for sale; but the demand for groundnuts has been an encouragement to natives, and quite large gardens have been planted this season in certain hill areas wherever sufficient seed was available.

An attempt was made this year to take advantage of the low stocks of local seed to import 50 tons of bunch type seed from elsewhere. However, this proved to be impossible and the attempt is being repeated in 1937.

It is still felt that there is scope for popularising groundnuts in those areas where cotton and tobacco cannot be grown. The introduction of higher-yielding strains would be a great encouragement; but the present native method of planting in widely distant rows is wasteful of space, encouraging to rosette disease and provides inadequate ground cover. Once good seed and a market are provided, there would appear to be a very good chance of establishing the crop by good cultural methods in a large area in the Dedza hills and the adjoining country in Dowa and Lilongwe districts. Apart from the value of the groundnuts as an economic crop, its extended cultivation would increase a useful food and rotation crop.

Castor seed.—Late in the season there was a demand for 10 tons of castor seed; but the late-ripening, poor-yielding native strains could not meet the demand. This year, however, a few cwts. of good-yielding seed multiplied at the E.C.G.C., Dowa and in school gardens have been issued on the Lake-shore to be planted as a hedgerow crop round food and cotton gardens. The resulting crop should be about 5 tons. If any further encouragement is given to this crop in the shape of repeated demand it may become a very useful sideline to cotton.

Rice.—With the exception of Kota Kota district, no quantity of rice has been offered for sale this year. A small acreage was sown down to rice in Dedza district, but the further rise of the Lake and hippopotami destroyed a large proportion. 26 tons were purchased in Kota Kota district at 3s. for a 60-lb. bag; but the supply was unequal to the demand. Here again, however, the demand has provided the necessary stimulus for renewed planting, and particular encouragement has been given to the planting of *Faya*—the whitest of local varieties. There is no doubt that the rise of the Lake has rendered useless many of the old-established rice gardens; but only encouragement is required to induce natives to make use of the newly flooded areas which have become available in many cases. It is confidently hoped that rice will form quite a profitable crop for the natives on the central Kota Kota Lake-shore where cotton cannot be grown.

## Native Agriculture and Extension Work.

The primary needs for an established agriculture in this district were briefly outlined in the district report for 1935. Progress in the desired direction has been necessarily very slow indeed; but it can be claimed that a start has been made. At present practically all efforts towards improved agriculture are confined to the cotton area, where all the staff is concentrated and where the presence of an economic crop makes the natives more willing to respond.

Rotation.—The chief need of the main, flat cotton areas is a simple rotation so as to restrict continued clearing for the extension of the crop. The Golomoti area has been chosen as the centre at which to begin rotation work, and from which it is hoped to spread the work year by year. Golomoti is a progressive neighbourhood, and cotton growing is more firmly established there than elsewhere. About one ton of pigeon pea seed is being distributed to the better growers for planting in tired maize gardens with the intention of multiplying the seed and establishing a rotation with cotton, maize and pigeon pea. It is not easy to prescribe an effective rotation for the native cultivator who naturally requires so much more maize than anything else; but the use of pigeon pea has the great merit of simplicity, and does not call for much additional work.

Windbreaks.—The large areas which have been cleared during the last few years in the Golomoti neighbourhood have created a need for windbreaks. This also is receiving attention; and, apart from leaving belts of natural timber, the division of large gardens by a belt of mango trees is being encouraged.

Soil conservation.—With the valuable assistance of the District Commissioner, soil conservation work has been extended in the Kota Kota foot-hills, and it is estimated that about 150 acres of native garden have been ridge-terraced on steeply sloping land. This also is a mere beginning, and the need for anti-erosion work in that area has increased rapidly with the introduction of cotton. The work of ridge-terracing will be further extended as soon as the crops are off the ground next dry season.

An additional area of about 30 acres has been ridge-terraced near headquarters in Dowa district; and, with the assistance of the District Commissioner, a demonstration plot has also been correctly bunded and planted by prison labour. The site chosen for this plot is immediately adjacent to the native market and the *boma* and should therefore receive the notice of a very large number of natives. At intervals it is intended to point out the purpose and method of soil conservation at organised meetings. The produce of the plot will be mainly utilised as prison rations.

School gardens.—Some of the school gardens begun last year have been discontinued owing to the difficulty of some missions closing their schools during what may be described as the garden season. The better gardens have been maintained and developed; but it could not be said that the full value was being obtained from them as yet. It is hoped to extend school gardens to the northern half of the district as soon as Mr. Cran has become fully acquainted with the routine work of his area.

Well sites.—The selection of well sites begun last year in the Bwanje valley and Dedza Lake-shore areas has now been completed, and the majority of wells in the former district has been sunk. Permanent water was obtained in a large proportion of the shafts ; but as yet few settlers have arrived. This was only to be expected since permanent water could not be guaranteed until November, by which time the making of new huts and gardens was out of the question. The present attitude of the natives towards the wells indicates that little fear need be felt for their settlement in 1937. New clearings should be watched from the start for the preservation of wind-breaks ; and the greatest benefit would be derived from the guidance of those responsible towards the erection of model villages in the newly-settled areas.

In co-operation with the District Commissioners concerned, further well-sites have been selected in the fertile areas of the Lake-shore plain in southern Kota Kota and Dowa. Another series of well sites has also been selected in conjunction with the Native Tobacco Board in the tobacco area near Mpali hill (Dowa).

Likoma Island.—At the request of the Bishop of Nyasaland, a visit was paid to Likoma Island in order to suggest, if possible, some means of reviving its long-exhausted fertility. A detailed survey simply served to confirm the opinion long held by others that the high infertility is due solely to intense and prolonged over-population. Nothing short of the enforced removal of at least half the population will effect any lasting improvement.

115 days and nights have been spent on *ulendo* in the district during the year.

R. W. KETTLEWELL,
Agricultural Officer.

# Report of the Agricultural Officer, Lower Shire and Chikwawa.

(*a*) *Weather conditions.*—The season 1935-36 will long be remembered as an abnormal one characterised by extremes of heavy rains, extensive and protracted floods and marked cold, grey, sunless conditions as the outstanding feature of the mid-season period of June/July.

The actual seasonal rainfall at an average of over 46 inches for the area as a whole constitutes the highest on record since the year 1925. February and March were particularly wet months registering no less than an average of 27 rain days to an average total precipitation of just over 20 inches.

Mid-season rains were in keeping with so wet a year but their association with long spells of overcast skies and low diurnal temperatures combined to other adverse factors of insect pests and disease made serious repercussions on the cotton crop and the ultimate short-fall in tonnage which was produced.

The Shire river again maintained a high level throughout the year. Heavy spates occurred during March, April and May and serious and extensive floods took place. Cultivations throughout the Nkhate-Chipatula-Munga flood-plain, the Ndindi marsh and the *madimba* areas situated along the course of the Shire were inundated. Severe losses to acreage under both food and cotton crops was a natural outcome. A certain amount of the maize was salved however but flood waters were slow to abate and it was unavoidable that much of the late planted cotton in the areas affected was put in at too advanced a date in the season to give anything but the poorest of results. The loss to food crops however was adequately balanced by heavy dry season cropping of maize and sweet potatoes.

It can be assumed that the water table now approximates to its highest limit and that the reserve of sub-soil moisture has been built up to full capacity in content.

(*b*) *Native Food Crops.*—The acreage put under food crops was fully adequate to the needs of the people and save where losses due to floods had taken place over a wide area of *madimba* land yields from the main crops of maize, bulrush millet and kaffir corn were good as a whole and probably well above average. Losses due to the activities of the locust were negligible when compared to previous years but wet harvesting conditions for the pearl millet crop tended to reduce yields in most areas. This latter loss however was balanced by the heavy production which the crop made in this season. A good rice crop grown on a rather bigger scale than is customary was negatived by the heavy floods but in those paddy cultivations which escaped heavy inundation yields were satisfactorily high. It is possible that could rice be taken in lieu of hut tax then it would stimulate the native to extend its cultivation in the excellent rice lands which exist in Lower River. The finger millet crop yielded well above average whilst the normal small scale cultivations under groundnuts and simsim gave good returns. The unusual activity of various insect pests accounted for somewhat reduced yields in the case of most pulse crops although pigeon pea was an exception and harvested a crop well above normal. The latter crop is becoming more popular in these areas and it is hoped that interest in it will become increasingly greater as time goes on. The return from the gram crop was for the most part good.

Results from dry season cropping in *madimba* areas were entirely satisfactory. Maize did well and an enormous acreage put to sweet potatoes gives promise of a prodigous tonnage. Kidney beans, *chimbamba*, did moderately well.

Restrictions placed upon the sale of food-stuffs and a commendable curtailment of the normal heavy brewing of beer which takes place annually went far to conserve food reserves in a more generous manner than is usual.

(2) *Economic Crops.* (*a*) *Cotton.*—The accepted policy to bring about an increase in the production of cotton was again pursued and serious attention was given to propaganda with this end in view.

The two additional seed depots of Ngabu and Tombondela were provided with a view to foster greater interest in the areas situated west of the Shire river and to the north of the Lilanje stream as well as along the course of the Mwanza river north of Chikwawa.

Seed depots commenced to open for distribution purposes as from December 9th and the following figures give the seed tonnages handled at the fifteen depots provided.

| Area | Depot | Seed in tons | Total tons |
|---|---|---|---|
| Port Herald ... | 1. Nyachikadza ... | 68 | |
| | 2. Kanjedza ... | 60 | |
| | 3. Port Herald ... | 160 | |
| | 4. Tengani ... ... | 55 | 343 |
| Chiromo ... | 5. Chiromo ... | 263 | |
| | 6. Munga ... ... | 148 | |
| | 7. Muona ... ... | 40 | |
| | 8. Masache ... | 40 | |
| | 9. Ngabu ... ... | 43 | 534 |
| Chikwawa ... | 10. Chipatula ... | 103 | |
| | 11. Luvunzu ... | 109 | |
| | 12. Maperera ... | 65 | |
| | 13. Nyali ... ... | 78 | |
| | 14. Tombondela<br>15. Nkhadana ... | 28 | 383 |
| | | 1,260 | 1,260 |

The total seed issued was greater than in 1935 by 36 per cent. (339 tons) and compares favourably with the number of issues made at 83,299 or an increase of 42 per cent.

The following table reviews the amounts of seed issued over the past seven seasons.—

| Year | No. issues | Seed in lbs. | Average issue in lbs. (approx.) |
|---|---|---|---|
| 1930 ... | 37,610 ... | 1,371,474 ... | 36.4 |
| 1931 ... | 30,900 ... | 1,466,868 ... | 47.4 |
| 1932 ... | 18,164 ... | 408,820 ... | 22.4 |
| 1933 ... | 45,177 ... | 878,643 ... | 19.4 |
| 1934 ... | 48,066 ... | 1,421,951 ... | 29.6 |
| 1935 ... | 58,864 ... | 2,063,312 ... | 35. |
| 1936 ... | 83,299 ... | 2,823,214 ... | 34. |

The 1936 census of cotton-growers and gardens at 33,879 and 35,395 respectively shows a further increase of growers at 11.1 per cent. (1,383) and in gardens 10.9 per cent. (1,303). It is considered however that these figures do not represent fairly the actual increases which had been obtained prior to the floods. With *madimba* gardens down by no less than 41 per cent. (approx.) on 1935 and conversely with non-flood lands up by 54 per cent. it is not unreasonable to assume that anything up to 10,000 flood-land gardens had been completely lost. Even so established acreages had been extended on all sides and as is borne out by the fact that the average weight of seed taken per grower was up on 1935 by 28.8 per cent. This latter figure however could be dropped to approximately 20 per cent. if it is reasonable to assume that the estimated loss of 10,000 gardens already referred to represents an equal loss in the number of growers. It would seem not unfair to accept the position in these terms.

In Lower river the satisfactory degree of interest now taken in cotton growing is at once obvious from the fact that growers constitute 79.4 per cent. of total hut owners. It should be noted that this figure is exclusive of Cholo growers in the fringing areas of Nsabwe and Ntondeza.

Seed was taken with alacrity and of the total issued somewhere in the vicinity of 78 per cent. of the final out-put was taken during the December/January period. With an allowance of 10 to 14 days made for the hiatus between receipt of seed and actual planting it can be accepted that anything up to 70 per cent. of the total acreage under cotton was planted by the end of January.

From the commencement the main crop generally made very good growth and by May picking had commenced in the more advanced areas. At this stage the appearance of the crop was of such excellence as to promise a further record in production by aiming to reach a conservative estimate of 8,250 tons and that despite heavy loss to acreage by floods.

A combination of adverse climatic and other factors during the months of June and July combined however to provide so serious a set-back that the ultimate tonnage realised fell far short of the estimate. The crop had broken well up to about mid-June but at this stage a long protracted spell of cold, wet, sun-less weather set in and breaking ceased. Bolls were seen to hang fire entirely yet at the same time there was little evidence of an undue amount of shedding. During this period the stainer population increased to its peak of infestation and to this latter factor in association with the well nigh impossible conditions of the mid-seasonal climate the staining fungus, *Nematospora sp.*, attacked the crop in so alarming a manner that bolls of all ages were infected and severe loss to production resulted thereto.

Plantings which had taken place up to the end of the first week in January broke well and gave satisfactory yields but these would have proved to be considerably better had the mid-season factor not arisen. A fact which would appear to be significant is that in 1935 plantings from mid-January to early in March had yielded satisfactory pickings by the third week in September whereas in 1936 breaking in this range of planting dates did not commence until the third week in September. In this connexion it is of interest to note that by the end of August, 1935, approximately 42 per cent. of the crop for that year had been marketed as against only 25 per cent of the estimated crop (8,250 tons) in the season under review.

Arrangements were made for the establishment of fourteen markets. These were Nyachikadza, Kanjedza, Port Herald, Tengani, Chiromo, Munga and Muona in Lower Shire and Masache, Ngabu, Chipatula, Maperera, Nyali, Mbuzi and Nkhadana in the Chikwawa district. The new market at Mbuzi replaced that of Tombondela. The object of this is to foster interest in the neighbourhood of the former market which along with that of Nkhadana can more equitably serve west-north-western areas of Chikwawa.

A further temporary adjustment had to be effected in respect of the Munga market. Owing to the high river level and the floodings which had taken place it was impossible to put a road through for the purpose of transport. Had suitable craft been available the market could have been readily and cheaply served by river but as this facility was not available it was necessary to make alternative markets at Mbenji and at Chinsomba. These two markets cannot be described as popular ones by the growers in the Munga area and it would seem wise for the future good of the industry to re-establish a market at Munga so soon as road or river transport can be arranged.

Five concerns again competed for the crop which was purchased in the open market as formerly. Competition was keen but it was unfortunate that in its train it brought about an extension of the multiple buying system. This practice which allows for two or three buying agents to operate under one flag is considered to be anything but desirable since not only does it produce discontent amongst agents when the crop is short but by creating unnecessarily unwieldy markets it reacts adversely upon the efficient administering of supervision and grade inspection by the staff of the department. The nett result is that there is a tendency for an unnecessary amount of badly graded cotton to be offered for sale and of which a certain amount is accepted by buyers in case it would go elsewhere if refused.

The first of the crop to come in was excellently graded and left nothing to be desired. Later on however when such of the stain affected crop which survived came on to the market the proportion of grade 1 cotton fell alarmingly. Whilst to a certain extent there existed a definite indifference to grading on the part of some growers it was nevertheless difficult for them to grade out a really satisfactory No. 1 in this season. The line drawn between grades Nos. 2 and 3 was definitely bad but the indifference already made mention of was aided and abetted by an absence of strictness on the part of certain buyers. Every effort was put forth to improve the position and by demonstration and the institution of as rigorous inspection as the combined circumstances of open markets, the use of bags and a shortage of staff would permit. A distinct improvement was attained and this was most marked in the case of grades 2 and 3 for as previously stated it was hardly possible to produce a true grade 1 in any quantity so seriously had the crop been damaged.

Prices opened high at $1\frac{7}{16}$d., $1\frac{5}{16}$d., and $1\frac{1}{16}$d. for grades Nos. 1, 2 and 3 respectively. The actual top prices paid per lb. were $1\frac{9}{16}$d. and the lowest $\frac{7}{16}$d. The average prices for the season were, No. 1 1.43d., No. 2, .93d., and No. 3, .66d.

The actual crop purchased was 4,624 tons valued at a total of £54,395. The average price paid per grower was £1, 12s. and the average yield per acre is assessed at 175 lb. The acreage under crop would be in the neighbourhood of 59,561 acres.

The institution of more orderly market layouts initiated by the District Commissioner, Captain C. E. Parker, M.C., provided a commendable advance on previous years. The concomitant benefits so derived were much appreciated generally and acknowledgment is due to Capt. Parker, for his energy in bringing about this creditable improvement.

It has been recommended already that rules be formulated to provide that markets should continue to be built on lines followed or a pre-arranged plan of layout.

The date for compliance with the uprooting and burning rules was put forward to November 15th but latitude was permitted in certain late areas in order not to react too harshly upon growers who had a reasonable amount of cotton to come in.

The number of offences under these rules are shown in the table below.—

| District | No. Offenders | per cent. | Total Growers |
|---|---|---|---|
| Lower Shire ... ... | 191 | .9 | 19,492 |
| Chikwawa ... ... | 961 | 7.4 | 12,963 |
| Cholo ... ... | 16 | 1.1 | 1,424 |
| | 1,168 | 3.5 | 33,879 |

Mention should be made that universal distaste to U/4 seed is being expressed on the part of the grower who does not appear to appreciate that it is the seasonal factor which is at fault for the poor results obtained and not the seed as he acclaims.

Tables 4 and 5 contain figures of interest as concern various aspects of the crop.

(*b*) Oilseeds—As in previous years little or no interest has been shown in groundnuts and simsim as economic crops. Castor has been particularly neglected in recent years.

(*c*) Cereals—To avert any shortage of food only strictly limited sales of pearl millet and maize were allowed under permit.

(*d*) Sisal—After many years of enforced idleness due to poor market prices the industry has returned to life. The Sankulani estate of Mr. Sabbatini was re-opened in May and by July the output was in the neighbourhood of 10 tons per 10 to 14 days. It is reported that up to 80 per cent. of No. 1 fibre is being obtained. A start on the Chikonje and Misanje estates of Messrs. The British Central Africa Co., Ltd., is imminent.

(3) *Experimental work.*—The main *mphala* station programme of field experimental work was again extended. It included (*a*) time-of-planting trial with cotton, (*b*) a combined spacing and time-of-planting trial with cotton, (*c*) a cotton strain trial, (*d*) a manure residual value trial with cotton, (*e*) a sorghum borer and fungus control trial, (*f*) trials of after-cropping short-age millet with various pulses (*Vigna* and *Dolichos* spp.), (*g*) the collection of data on cotton stainer infestations and (*h*) sundry trials of various mixed cropping systems and observations upon a number of recently introduced millets. The time-of-planting trial with groundnuts was elaborated to combine two spacings as well as the normal time-of-planting trial and with the further object of ascertaining what degree of *rosette* disease control might be obtained.

At the *dimba* sub-station the following trials were put in hand. (*a*) A spacing trial with maize, (*b*) a combined rice variety and method of planting trial, (*c*) the replication of the cotton strain trial and (*d*) trials of different mixed cropping systems and observations upon a series of ten pulse varieties. Arrangements were also made for replicating the collection of data on cotton stainer infestations along the same lines practised at the main station.

It is a matter for extreme regret that following upon the large amount of work entailed late floods should again have ruined the bulk of the season's work at the *dimba* station. The maize trial alone was harvested entire.

*Sorghums.*

The results of this trial were not significant.

*Treatment*, six.

*Replications*, six.

*Plots* 1/20th, acre.

| Series 1 | | Series 2 | |
|---|---|---|---|
| A. No compost applied | ... | D. No compost applied | |
| B. 5-ton compost/acre | ... | E. 5-ton compost/acre | |
| C. 10-ton compost/acre | ... | F. 10-ton compost/acre | |
| Planted 3′ × 9″ (1 plant) | ... | Planted 3′ × 9″ (1 plant) | |

| | *November 22nd.* | | | *December 19th.* | | |
|---|---|---|---|---|---|---|
| | No. compost | | 5 tons acre | 10 tons acre | | Total |
| Nov. 22nd ... | 352 | ... | 354 | 344 | ... | 1,050 |
| Dec. 19th ... | 298 | ... | 319 | 317 | ... | 934 |
| Total ... | 650 | ... | 673 | 661 | ... | 1,984 |

*Maize.*

*Variety. Kanjere.*

*Small plots*, 1/20th acre.

*Replications*, six.

*Planted*, November 23rd.

*Treatments*—

| | | | |
|---|---|---|---|
| A. | 3′ × 12″ (1 plant) ... | D. | 3′ × 24″ (1 plant) |
| B. | 3′ × 18″ (1 plant) ... | E. | 3′ × 24″ (2 plants) |
| C. | 3′ × 18″ (2 plants) ... | F. | Native method; 3′ × 3″ approx. (4—5 plants) |

*Analysis of variance*—

| | Deg. of freedom | Sum of squares | Variance |
|---|---|---|---|
| Rows ... | 5 ... | 2,196.95 | |
| Columns ... | 5 ... | 1,739.62 | |
| Treatments | 5 ... | 250.70 | 50.14 |
| Error ... | 20 ... | 1,998.64 | 99.93 |
| Total ... | 35 | 6,185.91 | |

The variance due to error being bigger than for treatments. The experiment cannot pass the *Z* test.

*Cotton.*

The average yield of seed cotton (all grades) obtained at the *mphala* station was 183 lb. per acre. This compares to an average yield of 259 lb. obtained in 1935.

*Time-of-planting*—This trial is of particular interest.

(*a*) *Time-of-planting—yield in lb.—seed cotton.*

| | Planting date | Treatment totals |
|---|---|---|
| A. | 7th December ... ... | 113.6 lb. |
| B. | 19th December ... ... | 110.7 lb. |
| C. | 7th January ... ... | 97.0 lb. |
| D. | 24th January ... ... | 58.7 lb. |
| E. | 16th February ... ... | 56.0 lb. |
| F. | 3rd March ... ... | 41.8 lb. |

N.B.—As formerly a uniform spacing of 3′ × 2″ (2 plants per hole) was followed out.

(*b*) *Cotton strain trial.*

| Strain | Grand Total |
|---|---|
| C.28 ... ... | 508.0 lb. per acre |
| N.3 ... ... | 467.5 ,, ,, |
| N.10 ... ... | 542.5 ,, ,, |
| Z.14 ... ... | 696.2 ,, ,, |
| U.442 ... ... | 582.9 ,, ,, |
| P.Hld. (mixed bulk) | 707.8 ,, ,, |

(*c*) *Combined spacing and time-of-planting trial.*

| Treatment | Planted | Spaced | | Treatment totals |
|---|---|---|---|---|
| D.1 | 19th December | 3′×1′ (2 plts.) | ... | 113.3 lb. |
| D.2 | | 3′×2′ (4 plts.) | ... | 107.8 ,, |
| D.3 | | 3′×3′ (3 plts.) | ... | 85.8 ,, |
| J.1 | 10th January | 3′×1′ (2 plts.) | ... | 124.6 ,, |
| J.2 | | 3′×2′ (4 plts.) | ... | 86.2 ,, |
| J.3 | | 3′×3′ (3 plts.) | ... | 83.4 ,, |
| F.1 | 12th February | 3′×1′ (2 plts.) | ... | 66.2 ,, |
| F.2 | | 3′×2′ (4 plts.) | ... | 43.4 ,, |
| F.3 | | 3′×3′ (3 plts.) | ... | 44.5 ,, |

| Treatment | | Totals | | Treatment | | Totals |
|---|---|---|---|---|---|---|
| D | = | 307.0 | ... | 1 | = | 304.1 |
| J | = | 294.2 | ... | 2 | = | 237.4 |
| F | = | 154.1 | ... | 3 | = | 213.8 |

*Manure Residual Value*:—

*Crop.*—Cotton (P.Hld., mixed bulk)

Plots.—1/20th acre

*Replications.*—six

*Planted.*—3′×2′ (2 plts). December 20th.

*Treatment manure rates* (1935)

| | |
|---|---|
| A and D ... ... | ... no manure |
| B and E ... ... | ... 5-tons/acre |
| C and F ... .. | ... 10-tons/acre |

| No manure | | 5 tons/acre | | 10 tons/acre |
|---|---|---|---|---|
| 318 lb. | ... | 357.8 lb. | ... | 355.3 lb. |

Cotton Stainer Infestation Records.—This work continues to be carried out in close collaboration with the specialist officers of the Empire Cotton Growing Corporation. Records were again obtained from twenty small units arranged symmetrically over the field in echelon. This arrangement provides five composite samples each comprised of four units. Collections of stainers from each plot or unit were made weekly and no attempt was made at collections from the rest of the field. The period March 30 to August 31. It is of particular interest to note that whereas *Dysdercus fasciatus* were most conspicuous in 1935 *Dysdercus intermedius* was much more prevalent in this season. The main peak of infestation took place at the end of May in 1935 but it was not reached until the end of July in 1936. This may well be co-related in part at least to the heavy and serious degree of staining which was present in the 1936 crop.

*Food Crops and General.*—

Condensed notes on crop observations and comments follow below.—

*Groundnuts.*—

(*a*) The value of early planting and the closer spacing (2′×1′) has been demonstrated by trial carried out in Field 3. The trial will be repeated in 1936-37.

(*b*) The Japanese bunch variety is a much less satisfactory yielder than the Spanish bunch variety. It also appears to be more susceptible to rosette disease.

*Cotton.*—

(*a*) So far as cotton is concerned it has been demonstrated that it is useless to attempt the inter-cropping of it with a long-age sorghum. This year a trial of cotton along with a short age sorghum (field $7b_1$) has shown that the former crop is able to give at least a small yield. The cultivation of these two crops in mixed cropping is not to be recommended however unless the sorghum (short-age) is spaced at wide intervals, *e.g.* sorghum 8′×9″ (2 plts.) cotton 4′×2′ (2 plts.). The latter method will be tested out on the station in 1936-37.

(*b*) The inter-cropping of cotton with short age bulrush millet can be looked upon as a good combination but a wider spacing of the millet would benefit the yield obtained under cotton. Wider spacing of the millet will be tested out during the coming season and the African agriculturist is being advised to increase his garden slightly in order that he may obtain his usual grain requirements with the wider spacing.

(*c*) Results from cotton and groundnuts or gram planted together are fairly satisfactory but a wider spacing of the groundnuts and gram seems indicated and further observations will be made on these lines.

*Millets.*—

(*a*) Bulrush millet—the short-age Transvaal variety is a very satisfactory yielder and its use can be encouraged with the fullest degree of confidence. This has been a bad season for pulses, otherwise it lends itself admirably to after-cropping with *Vigna* and *Dolichos* spp.

(*b*) Sorghum vars.—*ngonhko* is probably the best all-round variety amongst the several represented locally.

(*c*) Kaffir corn intercrops very satisfactorily with bulrush millet when sown as a mixed seeding (field 6d and 6e).

(*d*) The early varieties of Feterita (Fuelli. 1931 fayoumi) are small yielders and their grain is soft and stores badly.

(*e*) Finger millets grown under the nursery and transplant method gives satisfactory results. The local *maere* is a good yielder (field 8a2).

(*f*) Miscellaneous small millets—The varieties Morocco Yellow and Persian Yellow "A" and "B" so far appear to be outstanding in yield value when compared to the remaining eight varieties on trial.

*Pulses.*

(*a*) With the exception of green gram and pigeon pea results from pulses have been poor in this season.

(*b*) Pigeon pea has returned excellent yields and is a crop worthy of encouragement locally and with particular application to *masala* (fallow) gardens.

(*c*) Lima and tepary beans have not given good results at the main *mphala* station but the former shows more promise when grown on *madimba* soils.

(*d* Soya beans—Only the poorest stands with little or no yields have been obtained so far.

*Oilseeds.*—

(*a*) Simsim—Broadcast sowings give a satisfactory yield and require less field labour than the nursery and transplant method necessitates.

*Introductions.*—

(*a*) Spineless cactus.—Seven varieties were introduced in two different consignments from S. Africa but with the exception of *O. fusicaulis* the remainder died out with an attack of bacterial rot which developed shortly after the slabs were planted out.

(*b*) Old Man Saltbush.—Seed of the varieties *A. semibaccata* and *A. mumularia* failed to germinate.

(*c*) Sesbania spp.—A small seeding of this exotic was supplied by the forest department. It was sown 3′×9′ on December 18th. Germination was excellent. It has made rapid growth and now stands at over 10 foot in height. It has flowered freely and is setting seed. This undershrub would appear to offer possibilities for use as a wind break or for protection of stream banks. There is an abundance locally of an indigenous variety, *ndegerere* ('N) which closely resembles the introduced shrub. The latter withstood an exceptionally heavy attack by a pentatomid bug (*Brachyplatys Testudo Nigra*, de Geer) during June-July.

(*d*) Citrus.—Two of three grape fruit trees planted out at the *dimba* station in December, 1933, have made fair growth. They carried a few fruits in May of 1936. At date they are in heavy flower.

*Insect pest.*—The following were prevalent during the season 1935-36.

| Pest. | | Food Plant. |
|---|---|---|
| *Anticarsia irrorata* F. | ... | *Vigna and Dolichos* spp. |
| *Mylabrid* beetles | ... | *Vigna, Dolichos and Phaseolus* cotton flowers spp. |
| *Cosmophila erosa* | ... | Cotton (leaf-eater) |
| *Sylepta derogata* (1) | ... | Cotton (leaf-roller) |
| *Apthona bimaculata* | ... | Simsim (leaf eater) |
| *Epicauta velata* | ... | Maize and millet (fruiting heads) |
| *Prodenia litura* (F) | ... | *Dolichos* spp. |

(1) a *braconid* parasite emerged from one of a series of pupae from larvae fed-up in cage on the station. It is believed to be *Disophrys sp.*

The manufacture of both Indore and *rain-watered* compost was successfully accomplished on a larger scale than hitherto. At date of writing 28 tons had been put out at a dressing rate of four tons per acre.

Five and a half acres were green manured. The leguminous crops used were Dolichos and Vigna species.

The cattle on the station were treated for *trypanosomiasis* which again showed up during the month of May. The disease was responsible for the loss of four prematurely born calves. One healthy bull calf and healthy cow calf have been born during the year.

The work animals were fed a certain amount of cotton seed earlier in the year and during the present back-end a heavy weekly ration of green sugar cane grown at the *dimba* for this purpose is being cut for all animals.

The generous amount of help rendered in the statistical analyses of experimental results by Dr. Black, Assistant Chemist, and Mr. Hoyle, Assistant Cotton Specialist, is gratefully acknowledged. Mr. Leach, Plant Pathologist, has given valuable assistance also.

Whilst the work on the two stations has more than doubled itself during 1936 district work in connection with cotton and agriculture generally has also developed to the same extent to what it amounted but two or three years ago. It is felt that the agricultural officer, Port Herald, is really in need, and deserving of, an assistant.

*Native agriculture in general.*—

(*a*) Seed selection—Seed of the Transvaal variety of short-age bulrush millet was again readily taken by natives who realize its value as an early maturer and heavy yielder. A total of 3,740 lb. of seed was sold to 600 natives at usual price rate of five pounds per one penny. There was a small demand for seed of the Spanish bunch variety of groundnuts and 4,480 lb. were sold at 5 lb. per one penny (in shell) to 1,000 natives. In an endeavour to extend and encourage the growing of good quality rice 441 lb. of the proved North Nyasa varieties *faya*, *mele* and *msafili* were issued free to a total of 44 issues.

(*b*) Bush burning—A marked degree of improvement in respect of control has been obtained in the current year and the district administration are to be congratulated.

(*c*) Stream-bank protection—Efforts to obtain the effect desired continue to be put forth and there is reason to believe that some measure of progress has been made. Still more could be done in this connexion with concomitant benefit in the allaying of erosion.

(*d*) Advisory and extension work—A full course of instruction in the methods employed in the manufacture of rain-watered compost was given to teachers of the local mission institutions and the staff of native agricultural instructors. The various steps in the process were practically demonstrated from the stage of weed and trash collecting through the different stages up to the finished product. The demonstration was augmented by short talks on agriculture in general.

Native instructors make regular and close contact with mission teachers at the many district school centres. By so doing useful seasonal instruction in relation to all crops is more widely disseminated and it is hoped with advantage to native mission education in particular.

Further marked progress was achieved in respect of line-planting and there is evidence that many natives realise the value of this method over their own.

Demonstration plots have been commenced at Muona in the Chiromo area and at Mafumbe in the Chikwawa area. These are under the charge of the agricultural supervisors based on Chiromo and Chikwawa respectively.

The plots aim to demonstrate soil conservation and renovation, compost manufacture, simple rotations and good agricultural methods generally.

It is felt that in due season their influence will fully justify their establishment.

*Native agricultural instructors*—the staff has been enlarged from nine to a total of twenty five. The new men are the best that can be obtained locally for the money offered. They have had no previous agricultural training and it is hoped that at a later date a course of instruction may be made available for these and other instructors at a suitable training centre established for that specific purpose.

(*e*) *Agricultural Supervisors*—Mr. Carrall Wilcocks in the Chiromo area and Mr. G. D. Hayes in the Chikwawa area have rendered efficient and conscientious application to their various duties and their good work is acknowledged with the thanks that are due to them.

(*f*) *Locusts.*—The degree of infestation was light when compared to 1935 and the damage they caused to crops was negligible when taken over Lower River as a whole. The Entomologist has been kept fully and regularly informed of all movements, developments etc., throughout the year.

(*g*) *Acknowledgements.*—During my recent years in Lower River the British Cotton Growing Association have rendered me a great amount of courteous assistance and my sincere thanks are due to them.

FRANK BARKER,
Agricultural Officer.

# Annual Report of the Agricultural Officers, Zomba.

## (1) Native Food Crops.

Over the greater part of the area good rains fell and native food crops, planted early, promised to yield well. In the districts of South Nyasa and Upper Shire (northern part) rains were poor and very little maize had been planted by the end of 1935. In the former district seed maize was not too plentiful but there was enough for all gardens. During January rain was short and it was not until February that adequate rains somewhat relieved the situation.

Famine occured in the Fort Maguire area and in a number of Lake-shore villages the high rise in the Lake level flooded a number of gardens.

Early crops of green gram gave good yields.

Groundnuts germinated well and stands were good. In the Upper Shire District there was a shortage of seed and the resulting crop was a good deal below the average. Planting in many parts was slightly later than usual. By the end of January most gardens showed healthy plants but during February rosette disease was beginning to appear.

Rice gardens were smaller than usual in many parts of the area but in the Zomba and Mlanje district plantings were more extensive than usual. A very large quantity of rice, grown in Portuguese East Africa, was brought through Fort Lister Gap into Nyasaland and carried into Limbe and Blantyre for sale to Indians.

Cassava and sweet potatoes gave good yields. Leaf mosaic of the former crop was very common in all native gardens.

## (2) Economic Crops.

*Cotton.*—In the area under review the production of seed cotton by districts was as follows:—

| District | Productions in tons | | | | |
|---|---|---|---|---|---|
| | 1936 | 1935 | 1934 | 1933 | 1932 |
| Central Shire ... | 333 | 593 | 163 | 159.5 | 42 |
| Blantyre ... | 75 | | | | |
| Chiradzulu ... | — | 23 | | | |
| Mlanje ... | 113 | 383 | 63 | | |
| Zomba ... | — | 17 | 1 | | |
| Upper Shire ... | 40 | 132 | 4 | 4.5 | |
| South Nyasa ... | 89 | 241 | | | |
| Ncheu ... ... | 7* | 36* | 22 | 77 | |
| | 657 | 1,425 | 253 | 241 | 42 |

*South only

The total of 657 tons was a decrease of 768 tons from 1935.

The total amount of seed issued was 344 tons and for every lb. of seed issued 1.71 lb. of seed cotton were produced. The reason for this failure was undoubtedly climatic; cold, wet weather at a critical period in the life of the cotton plant induced stainer and fungus pests, which the plant, in its weakened condition, was unable to throw off.

The whole area was supplied with U4 seed.

The number of gardens in the area (excluding those in Cholo district which are included in the report for the Lower River) was 13,448, ninety-five per cent. of which were cultivated by the owner and his family; on the other five per cent. extra labour was employed. The number of gardens showed a decrease of 10,109. This is accounted for by the fact that Zomba and Chiradzulu districts grew no cotton at all and that certain areas in Mlanje and Blantyre districts cut down cotton production considerably.

The size of an average garden throughout the area was found to be just over 1 acre (1.05 acres). Roughly twice the size of the previous season. The mean yield per garden was however estimated at only 70 lb. (*i.e.* 70 lb. per acre) approximately one-fourth the yield of the previous season. Seventy-seven per cent. of the total crop was of No. 1 grade, a slight advance on last season's figure.

The cotton crop was purchased by six firms, three of which were represented at nearly every market. Even had the markets yielded normally the number of buying agents was far too many for the tonnages involved.

The average price per lb. between the six purchasers varied from 1.475d. to 1.176d. for good seed cotton, between .985d. and .809d. for ordinary and between .673d. and .494d. for stained. These prices were higher than those of the previous season.

The semi-controlled markets of the 1935-36 season were not so successful as was originally expected. Without barbed-wire fences and complete control by police the whole scheme of controlled markets is doomed to failure. It is obviously not part of the agricultural supervisors' duty to maintain law and order during market time but only too often during the past season they were called upon to do so.

### (3) Experimental Work.

No statistical experimental work was attempted as the station had to be left for a month to a native *kapitao* just at the critical time of year.

Observation plots on various native inter-planting methods were continued. Sorghum plots were ratooned for the first time and entered their second season with many gaps. One or two varieties appeared to stand ratooning quite well but most varieties showed some deaths and one or two practically disappeared. The plots will be ratooned for a second time next season.

Cotton was a complete failure but groundnuts, planted in November and very closely spaced, gave good yields. Seed for the 1936-37 season was supplied to various native authorities.

Selection work from native crops—beans, millets, maize and cassava continued.

Some experimental rice work was attempted and two strain trials were made in the Mlanje and Blantyre district. Neither were successful, the former on account of very sour, undrained soil. The latter yielded well but results were negatived because of the supplying of plots of all strains with seed of only one strain by the *kapitao* in charge.

It is becoming increasingly evident that the Makwapala Experimental Station cannot carry good maize or cotton crops and is therefore of limited agricultural value. Maize, the chief food crop of the country, and cotton, one of the two most important economic crops, should play a large part in any rotation or native cropping scheme and the value of the station for experimental or demonstration work is considerably diminished by their necessary omission. With frequent fallow crops of pigeon pea and heavy composting the land can be made to bear fair crops but the methods employed would be far too costly and involve too much work to be followed by the native cultivator.

The soil of the station is a poor shallow loam overlying in most places a laterized pan which is nowhere more than 2 ft. below the surface and in most fields only a sew inches. From the time the station was opened in 1923 until it was handed over to the Department in 1935 a continual battle was fought against soil erosion and even at the present time a very delicate balance has to be kept between holding the water up long enough for penetration but not long enough to cause water-logging or undue pressure on the contour ridges. Makwapala represents a very specialised soil type and cannot produce experimental results that are of value on what are at present the main economic and food crops of the country. Compost-making on a large scale was not started until 1936 but as has been said already it is doubtful whether anything but very large and quite uneconomic applications would restore the land to full fertility in the near future.

Certain crops such as groundnuts, millets, cassava, castor oil, sesame and various pulses, including possibly soya beans, all of which are of some importance at present and may become of increasing value in the future, grow readily and crop well on the station.

The land surrounding the station is of much the same type-poor eroded infertile soil—and any extension of the present 100 acres would be of little value. The cattle belonging to the station are allowed free grazing in the vicinity and in the dry season they are fed on silage.

For the next three years at least the greater part of the station might well be put under fallow crops of pigeon pea so that in any one year only one-third would be under economic or food crops. Useful breeding and selection work on the crops already mentioned has been done in the past and can still be done but it is a waste of time and money to continue growing maize and cotton

## (4) NATIVE AGRICULTURE.

During the past year the four agricultural supervisors continued to establish themselves in their districts and to continue their agricultural work among the villages. To reduce over-lapping between supervisors of the Department and the Native Tobacco Board it was decided that each agricultural supervisor should undertake the tobacco work in his own district and that in the more important tobacco areas the Native Tobacco Board Supervisors should undertake a certain amount of native agricultural work.

*Soil Conservation.* Fresh areas in the Mlanje and Chiradzulu areas were marked out by native *kapitaos* with road tracers, and natives in these areas were persuaded to contour-ridge their gardens. In the Fort Lister district, Mlanje, the agricultural supervisor in collaboration with the District Commissioner succeeded in having three villages moved from the hill slopes, where rapid erosion was taking place, to the plain. It was again apparent that only the closest supervision produced accurate work and that constant effort was needed to induce the owners to turn out to contour-drain their gardens.

*Compost.* On the Experimental Station the cattle kraals were moved to a fresh site, near a small stream, and compost work was continued under more promising conditions. Natives desirous of learning compost work were taken on at the station for three month courses ; they were given 6d. a week, food money, during the time they worked on the station. During the year twelve natives finished courses. Many of the native agricultural instructors were given a full compost course also.

*Native Agricultural Instructors.* No new instructors are engaged now until they have completed a three-month course in compost work during which they receive food money only and do all the compost work themselves. A further weeding out has taken place and many of the *kapitaos* engaged last year have had to be replaced. Very slowly a more reliable type of native is being found.

E. LAWRENCE<br>B. G. CHARLES } *Agricultural Officers.*

# Report of the Agricultural Superintendent, Lilongwe Experimental Station.

The following table shows the acreage under cultivation.

| | Crops | Trees | Total |
|---|---|---|---|
| Likuni ... ... | 70 | 23 | 93 |
| Chivua sub-station ... | 44 | 3 | 47 |
| | | | 140 acres |

Two 10-acre clearings were opened at Likuni bordering the main entrance road, one of which was on behalf of the Empire Cotton Growing Corporation. One 10-acre clearing of *dambo* land was opened at Chimvua. All new clearings have been bunded and drained.

During the year the station livestock was increased by 7 heifers and 2 bulls bringing the total up to 34 head. One cow and calf died of suspected arsenical poisoning, one cow of gall sickness, and one calf was taken by wild animals. Four trained oxen were purchased, and besides farm work, should prove useful in training young stock. All cattle were given a daily ration throughout the dry season, and in consequence retained their condition till just before the break of the rains. Hay was made of red grass, usually found in abandoned fields, and proved quite a success. The hay was not fed, but the cattle were allowed access to the stack morning and evening. A pasture of woolly finger grass was begun. It is intended to enclose this with a live hedge of *lunguzi* thorn, so that it will serve also as a paddock.

The success of the field stack method of compost manufacture has been one of the most promising features of the season. By this method the field waste is utilized to form a stack adjacent to the field to which compost is to be applied the following season, thus obviating the present difficulty of carting; a labour which in the past has proved a deterrent to the general use of manure among natives.

The cotton trials showed more promise than heretofore, yielding 400 lb. of seed cotton per acre. A further 10 acres is to be opened up this year. Windbreaks have been planted round all fields. The plantation of indigenous *mtete* trees continues to do well, and has been extended. The *msewa* appears to be too slow to be of any practical value. A plantation of *montana* tung nut trees shows some promise, although they are much slower growing than those planted in belts of higher rainfall. Three year old trees are now about 12′ high. Germination in the nursery was very poor, and seedlings are subject to attack by field mice.

Boreholes were put down at both stations and pumping plants installed. A dam was constructed across the Kakoma *dambo* near Chimvua as an object lesson to the native in the conservation of water supply.

An increased number of visitors both native and European were shown round the station. The increasing interest in agricultural matters displayed by the native is in some measure due to what they see and hear at these two stations. Natives were usually lectured on the elementary principles of agriculture, and then shown these principles put into practice.

Model small-holdings were started under selected cultivators both at Lilongwe and Chimvua.

## Field Work.

*Seasonal notes.*—From queries asked by visiting natives and from correspondence received occasionally from all over the district, it would appear that an increasing number of natives are reading these notes, and what is more gratifying are displaying an intelligent interest. The whole object of these notes is to stimulate interest and encourage the native to think for himself. They are written for the present and rising generations in particular. Father Lapointe of the Likuni White Fathers Mission has been kind enough to do the translation throughout the year.

*Ridge Terracing.*—An impetus was given to ridge-terracing activities by the addition of four more bunding *kapitaos*, bringing the total field staff to eight, and the creditable total of 3,983 acres was accomplished during the year. This brings the total area bunded in the Northern Province (under the control of the Native Tobacco Board) to 6,454 acres, and represents four years' work.

During the year two *kapitaos* were lent to the Agricultural Officer, Dowa, for work in the cotton area, and one *kapitao* has been sent to Fort Manning at the request of the District Commissioner. Closer supervision than formerly will no doubt result in the bunds being kept in repair, an omission which is fairly frequent at present.

*Village Demonstration Plots.*—All four market areas were served this season, each *kapitao* running a plot at his headquarters. The results on the whole were unsatisfactory. To quote my report, "The difficulties of obtaining accurate records become more apparent as time goes on, as the *kapitaos* do not, or will not, see their importance. It is impossible for the supervisors to give special attention to the plots at that time because they are fully occupied in fields and barns: the same applies in a degree to the *kapitaos*. The experiment will bear a closer resemblance to the truth if prolonged, or conducted afresh after an interval."

*Manuring.*—Encouraging reports come in from all supervisors so that it is apparent that the almost ceaseless propaganda conducted by supervisors and this station is at last bearing fruit. Field compost stacks may be seen frequently throughout the area, but particularly in the areas surrounding Lombadzi and Nsaru Central Buying Stations where the demonstrations were first started. The manure experiment at the station showed up very well and as a visual demonstration was most convincing. This exhibit was very popular with native visitors. The success of the field compost should do a lot to encourage natives to manure their gardens.

*Wheeled Transport.*—Mention of compost brings to mind the question of haulage. There is no doubt that the demand for carts of some sort is increasing. I have had several enquiries from natives, and have at last persuaded a local firm to import a trial consignment. A cart of local manufacture with wooden wheels and axles was attempted but was not a success. The few carts that are operating in the district are in great demand, and the fortunate owners are sometimes able to recover the cost of the cart in one season. An enterprising wholesale firm has the opportunity of opening a big potential market. Price is the limiting factor, but this should not be obtained at the expense of sound material.

*Pise-de-Terre Huts.*—More and more of these are to be seen in the district. To what extent they are due to propaganda or the shortage of building material it is difficult to say, but that they are becoming popular is to the good of the community in general.

*Cattle Management.*—Under the aegis of the veterinary officer the natives selected to ensure Lilongwe a clean milk supply continued to prosper. It is still considered unnecessary to feed cattle during the long dry season. This did not matter in the past, but now that the cattle are being put to some use it is essential that milk and draught animals at least be given a daily ration. In respect of better feeding, pasturages, rotational grazing, and the use of soya bean has been advocated, and a few natives have come in for woolly finger grass and soya. It is regrettable that no progress has been made in the matter of herding cattle during the dry weather.

The construction of roofed-in *kolas* is making headway, chiefly due to the untiring efforts of the veterinary officer, Mr. Wilson, and the supervisors. In the short space of a year appreciable progress has been made in the practice of mixed farming. The manufacture of compost, the use of implements the demand for carts, the use of manure, and the sale of animal produce, are signs of an awakening consciousness to the value of cattle to an agricultural community. 23 ploughs have been issued during the year.

*Seed Distribution.*—Issues of seed of soya bean, lima bean and cow pea were made in quantity to native cultivators; a small amount of edible canna were disposed of.

Sesbania and cassia have been distributed freely, particularly the latter. It is apparent that the natives are desirous of planting windbreaks.

## Conclusion.

A survey of the year's work gives some satisfaction; indeed, the outlook may be said to be bright. There is a distinct stir amongst natives to improve their living conditions, and it is necessary that every endeavour should be made to exploit this tendency. The possession of a regular income due to tobacco sales is having the effect of forcing many natives out of the rut of inertia, and this trend should be guided and encouraged in every possible way by those concerned. The Native Tobacco Board officers are aware of this opportunity and are doing everything possible to encourage it.

## Plans for 1937.

Ten acres are to be opened up for the Empire Cotton Growing Corporation at Likuni, but no further extensions are to be undertaken at either station. Greater attention is to be paid to upkeep roads and buildings

Two cattle kolas are to be built at Chimvua, and three at Likuni on the lines of those established at the Zomba Experimental Station. One engine house for water pumping plant is to be erected at Likuni, and the one at Chimvua is to be roofed.

## Experimental Work, 1936-37.

Rains broke early, but a dry spell towards the end of December held up planting of main tobacco crop. Excessive dull weather in February and March resulted in much hollow stalk in tobacco, bud shedding in legumes, and fungus in pearl millet.

*Potash Experiment with dark-fired tobacco, 3rd year, Latin Square.*

| Plot | Treatment | lb. per acre | Yield per acre (green leaf). lbs. |
|---|---|---|---|
| A. | Groundnut cake ... / Wood-ash ... | 300 ... / 200 ... | 3,620 |
| B. | Wood-ash ... | 300 ... | 4,210 |
| C. | Muriate/Potash ... | 45 ... | 4,790 |
| D. | Control ... ... | — ... | 4,125 |

There has been no response to potash fertilisers now for three years.

*Organic Manure Experiment with dark-fired tobacco, 3rd year, randomised block.*

| Plot | Treatment per acre. | Yield per acre (green leaf). lbs. |
|---|---|---|
| A. | Interplanted soya ... ... | 3,003 |
| B. | Compost—5 tons ... ... | 5,430 |
| C. | Control ... ... ... | 3,283 |
| D. | Cotton seed 1,000 lb. ... ... | 4,560 |
| E. | Groundnut cake—1,000 lb. ... | 5,600 |
| F. | Farmyard manure—5 tons ... | 5,980 |

Treatment differences are significant.

F. E. B. are better than D. C. A.

D. is better than A. C.

This corresponds to the results obtained last year. 3 year analysis of above experiment testing interaction season and treatment.

| Plot | Treatment totals for three years in lb. per acre. (green leaf). lb. |
|---|---|
| A. ... ... ... | 9,003 |
| B. ... ... ... | 12,943 |
| C. ... ... ... | 8,473 |
| D. ... ... ... | 12,397 |
| E. ... ... ... | 13,490 |
| F. ... ... ... | 14,487 |

In all cases differences are significant. Over a three year period, E. F. are better than A. C. D. B. is better than A. C.

*Interaction of season and treatment.*

Only in a medium year was farmyard manure better than compost. So it would appear that the season has no effect on the three best treatments.

*No. 1 Rotation Experiment, 3rd year, Latin square.*

| Plot | 1st year | 2nd year | 3rd year | Yield lb. per acre |
|---|---|---|---|---|
| A. | Fallow ... | Fallow ... ... ... | Millet* ... | 1,647 |
| B. | Sunn Hemp (dug in) ... | Millet (land not burnt over) ... | Millet (not burnt) ... | 1,480 |
| C. | Groundnuts ... | Maize (*organic matter) ... | Millet (not burnt) ... | 1,530 |
| D. | Pigeon pea ... | Pigeon pea ... ... ... | Millet* ... | 1,567 |
| E. | Sunn Hemp (cropped) ... | Millet* ... ... ... | Millet* ... | 1,240 |
| F. | Pigeon pea ... | Pigeon pea ... ... ... | Millet (not burnt) ... | 1,403 |
| G. | Fallow ... ... | Fallow ... ... ... | Millet (not burnt) ... | 1,423 |

*Land is subjected to heat by open fires as in the Vizozo method of the Angoni.

Differences are significant. A. is better than D. C. E. F. G.
D. ,, ,, ,, B. E. F. G.
C. ,, ,, ,, B. E. F. G.

New land burnt over (A), or deep rooted 2 year crop burnt over (D), gives best result, but closely followed by groundnut cake-maize rotation (C) without burning. Millet following millet gives a very poor result.

*Fertility Experiment 1st year, Latin square.*

| Plot | Crop | Treatment | Yield (unshelled) per acre lbs. |
|---|---|---|---|
| A. | Maize | Control (Ridges) | 4,246 |
| B. | do | Matutu | 3,366 |
| C. | do | Interplanted soya | 4,566 |
| D. | do | Compost (5 tons per acre) | 4,820 |
| E. | do | Farmyard manure (5 tons per acre) | 4,874 |
| F. | do | Rotation (tobacco, groundnuts) | 4,443 |
| G. | do | Rotation (soya) | 4,180 |

This is newly opened land. The treatment differences are not significant. White ants caused many poor stands.

*White Soya Variety Trial, 1st year Latin square.*

| Plot | Variety | Yield per acre (shelled) lbs. |
|---|---|---|
| A. | Midwest | 327 |
| B. | Barberton yellow | 403 |
| C. | Herman | 517 |
| D. | Yellow mammoth | 223 |

C. is better than A. D.
B. ,, ,, ,, D.
A. D. not significantly different.

D was planted later than the others due to infertile seed not germinating when first planted, and stock running short.

CHIMVUA.

*Fertility Retention Experiment, 1st year, Latin Square.*

| Plot | Crop | Treatment | Yield (unshelled) per acre. lb. |
|---|---|---|---|
| A | Maize | Control (ridges) | 5,909 |
| B | do | Matutu | 3,394 |
| C | do | Interplanted soya | 5,503 |
| D | do | + compost (5 tons per acre) | 6,683 |
| E | do | + Farmyard manure (5 tons per acre) | 6,909 |
| F | do | Rotation (tobacco, groundnuts) | 6,217 |
| G | do | Rotation (soya) | 5,554 |

Result. E is better than B.C.G.
D ,, ,, ,, B.C.
B is worst.

Old land. This experiment is a duplication of Likuni fertility retention trial on new land.

*Dark fired tobacco variety trial, 1st year, Latin square.*

| Plot | Variety | Yield per acre (green leaf). lb. |
|---|---|---|
| A | Western | 2,560 |
| B | Turtlefoot | 2,555 |
| C | Lizard tail Orinoco | 2,095 |
| D | Narrow leaf Orinoco | 2,365 |

No differences are significant. The Orinoco types are quicker maturing in the field than Western.

*Crops giving good results 1936.*

| Crop. | Variety | Remarks. |
|---|---|---|
| Tobacco | Western | In spite of hollow stalk, averaged 450 lb. to the acre. |
| Maize | Potchefstroom Pearl | Yields up to 2 tons per acre. |
| Sweet potatoes | Early Butter | Yields well and runs freely. |
| Sunflower | Black | 800 lb. per acre: vigorous. |
| Buckwheat | | 950 lb. per acre. Self sows freely. A very useful quick growing catch or cover crop. |
| Grass | Woolly finger | Slow starter, but vigorous once established. Much relished by cattle. |
| Finger millet | Kangumba | Yield 1,235 lb. grain per acre. Transplanted from nursery. |

*Crops giving promising results 1936.*

| Crop | Variety | Remarks. |
|---|---|---|
| Maize | Red | 1,400 lb. per acre: poor stand due to infertile seed. |
| Maize | Honduras yellow | 1,700 lb. per acre. Anchor roots weak. |
| Soya | O-too-tan | Did not yield as well as last year, but stands were poor due to infertile seed. Subject to bird attack when sprouting. |
| Soya | Herman | 375 lb. per acre shelled: best of white varieties. |
| Soya | Barberton yellow | 600 lb. per acre. |
| Oats | | Show promise. |
| Wheat | Droop | Promising. |
| Cotton | Various | 400 lb. seed cotton per acre. |
| Tung | Montana | 3 year old trees stand 12′ high. |

*Crops giving poor results 1936.*

| | | |
|---|---|---|
| Tobacco | Cash, Golden Dollar, Hickory Pryor | The season was too wet at the topping stage: all tobacco badly diseased. |
| Tobacco | Turkish | Above remarks apply. |
| Maize | Anveld | Planted too early: very susceptible to weevil when stored. |
| Pearl Millet | Transvaal, Nachacha | Suffered from cerebella disease. |
| Pyrethrum | | Never flowered, abandoned. 3rd year of trial. |
| Sunflower | White | Planted too early, quick maturing. |
| Beans | Cowpea | Vigorous top growth, but poor yield. Chimvua crop entirely ruined by rust: deflorated by mylabris beetle at Likuni. |
| Beans | Bush Lima | Too wet during March when buds were setting. |
| Sorghum | Feterita | Too wet in March. Subject bird attack when setting seed. |
| Broomcorn | | Too wet in March. |
| Groundnuts | Local | Poor yield, much rosette disease. |
| Cassava | ,, | Infected Mosaic. |
| Barley | 6 row | No yield. |
| Pigeon pea | Red | ,, ,, |

*Crops giving no decisive results 1936.*

| Crops | Variety | Remarks. |
|---|---|---|
| Soya | Biloxi, Midwest, Yellow Mammoth | Low yields. |
| Rices | Various (swamp) | Good appearance in field, but many empty heads on harvesting. Bungala best variety. |
| Sugar cane | Uba | Slow. |

R. E. JACKSON.

# Zomba Experimental Station.

The year under review can be considered satisfactory and progressive as shewn by the large production of seed and increase in yields of various crops. This is also a criterion that soil improvement has again been effected by rotations, green manuring and the application of Indore compost.

The station received a complete new lay-out which was satisfactorily completed before the planting season of 1936/37 commenced.

The part that animal husbandry plays in the economy of the station and in the organisation of a small-holding has been studied in such aspects as stall-feeding, the manufacture of compost, the establishment of special pastures and possible over-stocking.

Large quantities of dry bulky material were collected in Zomba and the record output of 200 tons of Indore compost reached. By the addition of more carts and the collection of further waste material from the area surrounding the station it will be possible to manufacture up to 400 tons, the greater portion of which could be issued to native growers in the Zomba District where it would be applied with lasting benefit to ridge-terraced gardens.

The cattle herd was maintained in satisfactory condition and the large quantity of foodstuffs available at all times contributed to their general fitness. Uba sugar cane, edible canna and bananas have proved their usefulness as succulent feeds in the dry season. Seven calves were born during the year and their condition at birth proves the importance of feeding minerals to the growing and adult stock.

The pastures have met with great interest from planters and others interested in the feeding of stock. The following grasses have been planted in one-acre plots and data will be obtained as to the number of grazing days per acre per annum of each of the following grasses.

*Chloris gayana.* Australian selected seed
*Chloris gayana.* Southern Rhodesian strain
*Digitaria Penzii.* Southern Rhodesian strain
*Digitaria Penzii.* South African strain
*Pennisetum purpureum*
*Pennisetum clandestinum*
*Panicum maxicum*
*Paspalum dilatatum*
*Paspalum urvellei*
*Haemarthria fasciculata*

During the year the seed stocks belonging to the Department of Agriculture were handed over to the station staff and all seeds issued and accounted for. A record of the number of issues is evidence of the importance that the station is taking when reliable seed stocks are required. Total number of issues to Europeans and natives amounted to 560. The total amount of seed of various crops grown on the station was 38,000 lb. being an average of over 5 cwt. per acre.

*Tobacco.* Leaf measurements of Western tobacco were continued and a large number of plants were selected as giving seed suitable for the production of leaf for the West African markets. All selected seed was issued to the Zomba District only. 450 lb. of Western tobacco seed was disinfected and issued to supervisors in the Southern Province.

*Economic crops.* With good prospects of being an alternative crop for European planters the *Aleurites montana* plantation was visited by a large number of planters and others. The results of experiments and other data were always at their disposal.

Records and measurements of the 128 five year-old montana are:

Height average, 12 feet, 8 inches.
Circumference 1 foot above ground level, average $12\frac{3}{4}$ inches.
Spread at widest point, average 15 feet, 3 inches.
Yield, average 9.6 lb. of dried fruits.
Sex of inflorescence,

| | 1935/1936 | 1934/1935 |
|---|---|---|
| Female flowers only ... ... | 73% ... | 49% |
| Male flowers only ... ... ... | 11.9% ... | 18% |
| Male and female flowers only ... ... | 8.7% ... | 26% |
| No blossom ... ... ... | 6.3% ... | 7% |

There is definite proof of the change of sex to trees bearing female flowers only. The only other reference on this important question is from Indo-China where records show that there is a tendency for males to predominate the older the tree becomes but no mention is made as to when this may take place.

Detailed experiments were conducted for the Economic Botanist, Royal Botanic Gardens, Kew, on the Chinese method of harvesting and fermenting montana fruits and samples were despatched from each experiment. All the experiments are to be continued on a larger scale the following season.

## Experimental Work.

Three experiments covering a period of five years came to an end in 1936. These included the effects of various manuring and rotations on the crops of maize and tobacco.

*No. 1 Experiment.*

This included the following treatments over three years in the form of a Latin square, each plot being 1/30th acre.

1. 10 tons cattle manure per acre.
2. 1,000 lb. cotton seed per acre.
3. Control.
4. Green manure.
5. 5 tons cattle manure per acre.

*The crops were*

1934. Hickory King maize
1935. British Honduras Yellow maize
1936. Root Rot Resistant Barley,

The yields of green leaf in lb. for each plot were:—

| | | | | |
|---|---|---|---|---|
| 5 | 1 | 2 | 3 | 4 |
| 141 | 217 | 89 | 190 | 115 |
| 4 | 5 | 1 | 2 | 3 |
| 64 | 166 | 176 | 95 | 99 |
| 3 | 4 | 5 | 1 | 2 |
| 41 | 37 | 121 | 168 | 113 |
| 2 | 3 | 4 | 5 | 1 |
| 41 | 23 | 41 | 151 | 195 |
| 1 | 2 | 3 | 4 | 5 |
| 178 | 30 | 58 | 41 | 172 |

Statistical examination of the results was made by the Assistant Chemist as follows:

Analysis of Variance.

| | Degrees of freedom | Sum of Squares | Mean Square. | log 10 M.S. |
|---|---|---|---|---|
| Rows ... | 4 ... | 10502.9 ... | 2623.2 | |
| Columns | 4 ... | 7851.9 ... | 1963.0 | |
| Treatments | 4 ... | 50629.5 ... | 12657.4 ... | 4.1023 |
| Error ... | 12 ... | 22153.9 ... | 1846.2 ... | 3.2663 |
| Total | 24 | 91138.2 | | |

For the Z test $Z = (4.1023 - 3.2663) \frac{2.303}{2} = 0.964$

$Z\ (P = 0.01.\ n_1 = 4.\ n_2 = 12) = 0.8443.$

Hence the treatment differences are significant.

The results of the experimental treatments are:

| Treatment ... | 1 | 2 | 3 | 4 | 5 | Mean | S.E. |
|---|---|---|---|---|---|---|---|
| Yield ... | 934 | 368 | 411 | 298 | 751 | 552.4 | 96.1 |
| % of Mean ... | 168.9 | 66.6 | 74.4 | 54.0 | 135.0 | 100.0 | 17.4 |

Test for significant differences = 3 × S.E. = 52.2.

Using this test treatments 1 and 5 are significantly better than any other treatment but there are no significant differences between 1 and 5 and between the other treatments. This indicates the superiority of cattle manure over cotton seed or green manure which do not differ from the control.

*No. 2 Experiment.*

This experiment was laid out on the random block system, each plot being 1/20th acre.

*Treatments.*

| 1935. | | 1936. |
|---|---|---|
| 1. | Tobacco continuous from 1927. ... | Tobacco |
| 2. | Maize ... ... ... | Tobacco |
| 3. | Velvet Beans ... ... | Tobacco |
| 4. | Soya Beans ... ... | Tobacco |
| 5. | Sunn Hemp ... ... | Tobacco |

The yields of green leaf in lb. for each plot were:—

| | | |
|---|---|---|
| 4 | 1 | 5 |
| 121 | 157 | 177 |
| 2 | 5 | 4 |
| 106 | 168 | 113 |
| 5 | 4 | 1 |
| 100 | 52 | 89 |
| 3 | 2 | 2 |
| 84 | 103 | 100 |
| 1 | 3 | 3 |
| 46 | 80 | 83 |
| 2 | 3 | 5 |
| 171 | 67 | 78 |
| 4 | 2 | 1 |
| 71 | 113 | 42 |
| 5 | 5 | 3 |
| 131 | 138 | 125 |
| 3 | 4 | 4 |
| 108 | 118 | 82 |
| 1 | 1 | 2 |
| 62 | 96 | 132 |

Analysis of Variance.

| | Degrees of freedom | Sum of squares | Mean square | Log 10 M.S. |
|---|---|---|---|---|
| Blocks ... | 5 ... | 2344.8 ... | 469.0 | |
| Treatments | 4 ... | 11048.5 ... | 2762.1 ... | 3.4412 |
| Error ... | 20 ... | 24127.7 ... | 1206.4 ... | 3.0814 |
| Total | 29 | 37521.0 | | |

For Z test $Z = (3.4412 - 3.0814) \times \frac{2.303}{2} = 0.414.$

Z (for P = 0.05, n1 = 4, n2 = 20) = 0.5265.

Therefore the treatments are not significantly different in 1936, although in 1932 and 1934, significant results were obtained.

Random block system, the plots being 1/40th acre.

Treatments.

| | 1932 | 1933 | 1934 | 1935 | 1936. |
|---|---|---|---|---|---|
| 1. | Pigeon Pea | Pigeon Pea | Pigeon Pea | Maize | Tobacco |
| 2. | ,, | ,, | Soya Bean | Maize | Tobacco |
| 3. | ,, | ,, | Tobacco unmanured | Maize | Tobacco |
| 4. | ,, | ,, | Tobacco manured | Tobacco | Tobacco |
| 5. | ,, | ,, | Sunn Hemp | Maize | Tobacco |
| 6. | ,, | ,, | Tobacco 5 tons cattle manure. | Maize | Tobacco |
| 7. | ,, | Bush Rotation | Bush Rotation | Tobacco | Tobacco |
| 8. | ,, | Pigeon Pea | Cow Pea | Maize | Tobacco |
| 9. | ,, | ,, | Tobacco 3 tons compost. | Tobacco | Tobacco |

Analysis of Variance

| | Degrees of freedom | Sum of squares | Mean square | Log 10 M.S. |
|---|---|---|---|---|
| Blocks ... | 5 | 3881.2 | ... 776.2 | |
| Treatments | 8 | 10644.9 | ... 1330.6 | ... 3.1240 |
| Error ... | 40 | 10993.4 | ... 274.8 | ... 2.4391 |
| Total ... | 53 | 25519.5 | | |

For Z test $Z = (3.1240 - 2.4391) \times \frac{2.303}{2} = 0.787$

Z (for P = 0.01, n1 = 8, n2 = 40) 0.5773

Therefore the treatment differences are highly significant.

The results of the experimental treatments are:—

| Treatment | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Mean | S.E. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Yield ... | 336 | 230 | 321 | 323 | 280 | 447 | 227 | 304 | 492 | 328.89 | 40.61 |
| % of Mean | 102.1 | 70.0 | 97.8 | 98.4 | 85.1 | 136.0 | 69.0 | 92.5 | 149.8 | 100.0 | 12.3 |

Test for significant differences 3 × S.E. = 36.9

Using this test treatments Nos. 6 and 9 are significantly better than any of the others with the one exception that No. 1 and No. 6 are not quite significantly different. Among the other treatments there is no significant difference but Nos. 2 and 7 just fail to be significantly less than treatment No. 1. Treatment No. 6 involved 5 tons cattle manure and No. 9, 3 tons of compost in 1934—1935; all the other treatments involved rotations and green manures. The result of the experiment thus proves the efficiency of organic matter for dark tobacco.

*Plant introductions.*

These were few in number and are detailed below.

Seed Oats, Abundance, Victory, White Winter, Marvellous and Black Tartarian varieties. Black Tartarian is the heaviest yielder followed by White Winter.

Seed Barley. Plumage Archer and Spratt Archer varieties. The latter is the heaviest yielder having produced 40 lb. of seed from one lb. of seed sown.

Miscellaneous seeds. *Pitchecolobium saman*, Shade tree for coffee. Kent's Hybrid Coffee. For experimental purposes.

Groundnuts. Santa Fe and Cordoba varieties.

Lima Beans. From California Lima Bean Association for trial.

*Miscellaneous.*

Co-operation with tobacco supervisors in the Southern Province has been excellent and seeds of green manures, cover crops, and other plants were issued when required.

At the Plant Introduction Station in Zomba, trials with varieties of sugar cane, *Bassia longifolia* and the Tara Bean were continued. The brush wood and trash collected helped considerably in the manufacture of Indore compost. A full report on the experimental and extension work of the station during the past ten years is in course of preparation.

Masambanjati Coffee Sub-station. All *arabica* coffee experiments have been transferred to this station and interesting data will be obtained on coffee grown under indigenous shade, the effect of ground and cover crops, and the importance of aspect. The growth of the coffee in the experimental plots is good and these plots will prove their use as a reliable source of supply of good coffee seed for future extension.

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A. J. W. HORNBY.

A. B. CORMACK.

# Nyasaland Cotton Experiment Station, Domira Bay, Progress Report for the Season 1935-36.

BY

H. C. DUCKER, W. L. MILLER AND S. T. HOYLE.

## SEASON.

The rainfall total for the season was 34.46 inches, 5.79 inches more than in 1934/35, and, with the exception of 1931/32, the highest recorded on the station. In that year, however, though 36.10 inches fell, the distribution was good throughout the season and high yields were obtained. This past season, good rains had fallen by December 12th and most of the planting was completed by December 20th. Two weeks hot rainless weather followed which necessitated some supplying, but in general little harm was done to the crops. Light rains carried on at reasonable intervals through January to mid-February, but from then on conditions become bad, particularly from a cotton point of view.

From February 15th to 29th, 11.21 inches of rain were recorded, followed by 10 inches to March 25th, during which period there was but little sun and much water-logging occurred. From March 25th less than 0.5 inches fell during the remainder of the season.

This was an almost complete reversal of the conditions of 1934/35, when no effective rain fell between February 9th and March 16th after a period of excessive moisture supply, and the results from a cotton point of view were even more disastrous.

## COTTON.

At the beginning of the 1934/35 cotton report emphasis was laid on the seasonal rainfall distribution. Even greater emphasis can be laid on that of this season which has resulted in the lowest yield per acre from the bulk crop yet recorded, approximately 140 lb. lint per acre against a normal crop of 250 lb. lint.

Against this, however, may be set the fact that in both 1934/35 and 1935/36 certain quick maturing strains have given good yields, particularly certain of the Gatooma strains and some early selections made at Domira Bay. With two so markedly contrasted seasons one may feel some confidence in strains which have done well in both. In the breeding block re-selection work within the U.4 lots has been continued, and most encouraging results were obtained with re-selections from Z.14, a strain selected at Barberton in 1928 which has now been re-selected at Domira Bay since 1931. This strain led in the strain trial in 1933/34 and this year has again shown itself a significantly higher yielder than its fellows. It is somewhat similar in habit to certain of the successful Gatooma strains. C.28 which has been a consistently good performer did not this year show to such advantage as in previous seasons, but in the strain trials its yield was as good as or better than, all except Z.14.

Four new strains from Barberton did well in observation plots, and will be included, with the best of the Gatooma strains, in the trials next season.

The cross-bred material has been carried on for another generation and, as with the U.4 lots, the earliest strains showed to greatest advantage this season. This was particularly so with the crosses containing Gambia Native and with certain of the (U.4 × Cambodia) × U.4, while (Meade × U.4) × U.4 N.10 gave some high yields and good staple.

Certain lots containing no U.4 in their parentage also did well, particularly Over the Top × Harland's Big Boll (jassid-resistant re-selection), which provided a striking plot; Over the Top × S.G.29 also yielded well.

Cotton Experiments.—A manurial trial, laid down for the first time at Domira Bay, gave no significant results other than an increase shown where cotton bushes were burned *in situ* on one series of plots. This is of local interest in that up-rooting and burning regulations, enforced in Nyasaland, may be of value to the cotton crop apart from their effect in pest control. Soil fertility as such does not appear so far to be a limiting factor at Domira Bay.

A spacing experiment again failed to give results showing any significant differences, but it is of interest to note that a spacing of 3″ × 2″ leaving three plants per hole at thinning, has for the third time given the highest yield. A similar result has been obtained at the Port Herald District Station.

A topping and thinning experiment was suggested by a number of enquiries received from various parts of the country. This failed to show any significant differences between the treatments given; three times of thinning and three times of topping were tested. Time of thinning does not appear to be of any importance up to the time the plants have 8—10 leaves, while topping made no difference to the final crop. It was observed that the topped plots seemed to "show" more cotton than the untopped plots.

A cultivation experiment was introduced for the first time and produced some striking results. Ordinary weeding without inter-cultivation, ordinary weeding with thorough inter-cultivation, and the normal native practice of minimum weeding without inter-cultivation were compared. In the case of the last named, advice was given by an ordinary native cultivator as to when weeding should be done, and faithfully followed. Even though the cotton in the native practice plots appeared to make good recovery after being nearly smothered in weeds, a common experience for young cotton in native gardens, it gave a yield significantly lower than that of either of the other treatments. There was no significant difference between the other treatments, and deep hoeing between cotton appears to be a waste of time and money.

If the results of this experiment are confirmed it would appear that propaganda for early weeding alone might result in a 30 to 40 per cent. increase in the native crop.

The three strain trials using 6 × 6 Latin squares that were laid out showed that the re-selected Z.14 was significantly higher yielding than the standard station cotton C.28.

A uniformity trial, using Z.14 was carried out. 490 rows, forming in all a rectangular block of just under one acre, each row being 7 yards long, were harvested and weighed separately and the results sent to Rothamsted. The thanks of the Corporation are due to the Statistical Department at Rothamsted for their examination and report on these results. It seems that the standard plot used on the Station appears to be as good as any. This is 16 yards square, of which 14 yards square is used at harvest.

## Pests.

Locusts.—The first swarm of Red Wing locusts for the season was not seen until January 22nd. Large numbers settled in one corner of the Station, but did no damage and passed on the following day. A second swarm arrived on February 7th and stayed on the Station, settling mainly in the then half grown maize. Egg-laying started almost immediately and by early March hoppers were numerous in patches. Some maize was nearly completely defoliated, but cobs were well formed by the time this occurred and the loss was small. Very slight damage was done to cotton. Adult locusts were in evidence till June and are still (November) to be found in the fields under standover pigeon pea. It appears that they are now in the "dissocians" phase and that Domira Bay may have seen the worst of the locust invasion.

Cotton pests.—Records of Stainers and bollworms were kept as in the 1934/35 season, and the progress of the pest cycle followed. This work is now being done in close co-operation with the Insect Pest Control Section at Barberton.

At the Station the activities of the pests this season were definitely secondary to the effects of the season on the cotton crop, and the fact that what crop was made was early for the most part resulted in a much lower percentage being stained than was the case in 1935.

## Rotation Crops.

On the whole, the various rotation crops, with the exception of certain beans, did much better than in 1934/35.

The average yield of mass selected Potchefstroom Pearl maize from 20 acres was over 3,000 lb. per acre.

The performance of the selections from native maize, of which 35 were retained from last year, was noteworthy. A five acre field gave 900 lb. more per acre than did the Potchefstroom Pearl bulk, a somewhat surprising result since yield per acre was not primarily considered in making these selections, but weevil and grain moth resistance. A variety trial will be arranged next season; twenty re-selections have been retained.

Groundnuts did well, the average yield on 7½ acres being 1,300 lb. per acre.

A combined spacing and variety trial showed that Barberton bunch was a significantly higher yielder than the Station Virginia Bunch, but not significantly better than either of the other varieties tested, Gambia and Nyasaland Native. The difference shown between the two spacing arrangements tried were not significant.

Tepary, Bush Lima, and haricot beans were all failures, but nine varieties of soya procured through Barberton showed much promise. Root nodules were found on one of these varieties, "Ami" from Bremersdorp, though no inoculation had been done. This variety made the best growth and cover, but shattered rather badly at harvest.

Sorghum and bulrush millet plots did well, a variety of bulrush millet from Port Herald being the best of its type.

One field was given up to inter-cropping cotton with various rotation crops. The latter almost without exception did well, but the cotton was a failure. It would not appear that cotton grown as at Domira Bay as a summer crop, can be satisfactorily used in crop mixtures. The problem will be rather to find the best ways of arranging it in rotation with other crops, and for this purpose a large scale rotation experiment is being planned. This should provide information regarding the present standard rotation in use on the Station and indicate how it may be improved.

## Cattle.

Except in one or two favoured places, there are no cattle in the S.W. Lake-shore areas owing to tsetse fly. An experiment has been commenced to test the practicability of keeping cattle, subject to intermittent infections of trypanosomiasisis, in reasonable condition by suitable treatment. This if successful may lead to an extension of cattle-keeping, and later perhaps to fly clearance schemes being justified.

Ten native bullocks have been purchased, and brought down to the Station. Blood slides are being taken weekly for examination by the Veterinary Department, which is co-operating in the scheme, and the cattle showing infection as well as marked clinical symptoms are treated by injection with Antimosan (Bayer) or antimony tartrate. So far the degree of infection has been low, and there are indications that native cattle that are being used in this experiment have a marked degree of tolerance to trypanosomes.

One bullock has died from an unknown cause, not corresponding in its symptoms to trypanosomiasis, and not discoverable by *post mortem* examination. The others are in good condition and already at work, ploughing and ridging.

A considerable area of bush has been cleared on the west side of the Station, and the station clearing has been linked up with that on the nearby Chitala Estate. By this means it is hoped to keep back "fly" and lower the incidence of infection for the cattle.

Much assistance has been given by Mr. B. D. Burtt of the Tsetse Survey, Tanganyika, who has paid an extended visit to the Lake-shore areas, by Mr. J. De Meza the Chief Veterinary Officer, and by the District Veterinary Officer, Mr. S. G. Wilson.

A commencement has been made with compost making on the lines previously used at Makwapala and reported on some years since.

## Buildings.

A third house on the Station was completed, and occupied by the Cotton Specialist, during the year. Eight more double brick huts have been added to the labour lines, which are now fairly complete; the type of brick hut erected is in favour with the native labour. A brick cattle yard of the covered type has been built; it is provided with an open outer yard and crush pen. In addition a small isolation hospital for cattle has been built on the advice of the Veterinary Department.

The plinth of the main storage tank at the borehole has been raised to improve the head of water, and the pipeline extended to the power house and to a cattle trough, which has been built near the latter building.

At Lilongwe a combined store and office, a most serviceable building, has been built on the Corporation's behalf by the officer in charge of the Likuni Experimental Station. This is conveniently sited in relation to the other buildings and to the cotton section of the Station.

## Lilongwe.

Excellent results were obtained with cotton at this Station, where the rainfall was somewhat better distributed than at Domira Bay. The difference was not such, however, as to explain entirely the results, which were undoubtedly due to the fact that only very quick maturing strains were planted at this Station. Stands were very patchy owing to a rough tilth and very low seed rate, and hardly exceeded 40 per cent., but in spite of this, over two tons of clean seed cotton were harvested from the ten acres sown. A large number of single plant selections were made.

There was little to choose between the best of the Gatooma strains and the best of the Lilongwe crossbred lots.

A number of outside plots were grown, planted on various European estates. Of these, three which were planted at the same time as the Experiment Station gave comparable results, but others, which from one reason or another were later, were failures.

Lilongwe undoubtedly provides the most extreme "summer crop" conditions under which cotton is likely to be grown commercially in Nyasaland; any delay to the flowering and bolling, from whatever cause, is fatal to the crop.

## The Cotton Industry In Nyasaland.

The cotton crop in Nyasaland this past season has failed to come up to early expectations. It is not completed at the time of writing, but it does not appear that the yield will be more than 10,000 bales as against the 27,000 bales expected when seed issues were made.

The season has had most to do with this failure, assisted by other factors. The Lower River areas for example, after two good years at the end of dryish cycle of season, appear to be definitely back again in a wetter cycle of seasons. Under these changed conditions, early planting propaganda, which in the dry cycle had certainly given results of value, proved disastrous in that it had resulted in the practical elimination of a close season sufficient to control Red Bollworm (*Diparopsis castanea*).

The effects of this have shown up immediately on the return of wetter conditions, and planting practices will again have to be modified to meet this threat. A close season of six weeks has been arranged for this year, to be extended if possible to eight weeks in 1937/38.

Unfortunately the up-country areas were unable to redress the balance, since in addition to the greater part of their area receiving a rainfall distribution comparable with that of Domira Bay, there was the complication of partial famine in many districts.

This made the natives anxious about their food crops, which rightly received prior attention, but with the dry spell which occurred after December 20th, it resulted in little cotton being planted before January with, as might be expected, poor results. Experiments at Domira Bay and elsewhere have shown clearly that summer crop areas must be planted in December.

Fortunately prices to the native grower have been good, and he is not easily upset by adversity. This year food supplies are excellent and there is every indication that an increased cotton seed distribution will take place. It is to be hoped that the rains will be favourable.

## EUROPEAN AGRICULTURE.

| Name of district. | Total acreage under cultivation. Acres. | Tobacco. Total. Acres under crop. | Tobacco. Total. Yield cwt. | Tobacco. *Fire-cured.* Acres under crop. | Tobacco. *Fire-cured.* Yield cwt. | Tobacco. *Flue-cured.* Acres under crop. | Tobacco. *Flue-cured.* Yield cwt. | Tobacco. *Air-cured.* Acres under crop. | Tobacco. *Air-cured.* Yield cwt. | Tea. Acres under crop. | Tea. Yield cwt. | Coffee. Acres under crop. | Coffee. Yield cwt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lower Shire | 616 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Chikwawa | 233 | 130 | 607 | ... | ... | *130* | *607* | ... | ... | .. | ... | 7 | 4 |
| Central Shire | 401 | 200 | 249 | *90* | *134* | *110* | *115* | ... | ... | ... | ... | ... | ... |
| Cholo | 16,933 | 1,622 | 5,267 | *60* | *109* | *1,562* | *5,158* | ... | ... | 7,636 | 14,886 | 286 | 157 |
| Mlanje | 13,798 | 846 | 2,359 | *328* | *1,171* | *450* | *1,034* | *68* | *154* | 8,710 | 50,938 | 90 | 70 |
| Blantyre | 5,381 | 1,289 | 4,466 | *222* | *228* | *1,067* | *4,238* | ... | ... | ... | ... | 179 | 176 |
| Chiradzulu | 2,480 | 54 | 88 | *30* | *70* | *24* | *18* | ... | ... | ... | ... | 4 | ... |
| Zomba | 2,453 | 558 | 1,853 | *60* | *133* | *488* | *1,698* | *10* | *22* | ... | ... | 4 | 1 |
| Upper Shire | 187 | 78 | 230 | *72* | *230* | ... | ... | *6* | ... | ... | ... | ... | ... |
| South Nyasa | 1,506 | 1,045 | 4,033 | ... | .. | *1,045* | *4,033* | .. | .. | ... | ... | 26 | 1 |
| Ncheu | 1,415 | 913 | 2,083 | *324* | *906* | *407* | *1,054* | *182* | *123* | ... | ... | 10 | 3 |
| Dedza | 407 | 34 | 60 | ... | ... | *34* | *60* | ... | ... | ... | ... | 1 | 2 |
| Fort Manning | 607 | 213 | 1,035 | *40* | *440* | *20* | *590* | *153* | *5* | .. | ... | ... | ... |
| Lilongwe | 3,002 | 362 | 1,444 | *186* | *800* | *58* | *221* | *118* | *423* | .. | .. | .. | ... |
| Dowa | 1,423 | 5 | 6 | ... | ... | *5* | *6* | ... | ... | | | ... | ... |
| Kota Kota | 14 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .. |
| Kasungu | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mzimba | 185 | ... | ... | ... | ... | .. | ... | ... | .. | ... | ... | 150 | 64 |
| West Nyasa | 1,324 | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... |
| North Nyasa | 139 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 80 | 55 |
| Total | 52,504 | 7,349 | 23,780 | *1,412* | *4,221* | *5,400* | *18,832* | *537* | *727* | 16,346 | 65,824 | 837 | 533 |

NOTE:—TEA: Acreage in plucking 1936 was 14,385. COFFEE: Acreage in bearing 1936 was 463.

## EUROPEAN AGRICULTURE—CONTINUED.

| Name of district | Sisal. Acres under crop. | Sisal. Yield cwt. | Cotton. Acres under crop. | Cotton. Yield cwt. (lint) | Rubber. Acres under crop. | Rubber. Yield cwt. | Chillies and Capsicums. Acres under crop. | Chillies and Capsicums. Yield cwt. | Maize. Acres under crop. | Maize. Yield cwt. | Wheat. Acres under crop. | Wheat. Yield cwt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lower Shire | 302 | 3,200 | 211 | 515 | ... | | ... | ... | 45 | 216 | ... | ... |
| Chikwawa | ... | ... | 15 | 6 | ... | ... | ... | ... | 23 | 260 | ... | ... |
| Central Shire | ... | ... | ... | ... | ... | .. | ... | ... | 35 | 270 | ... | ... |
| Cholo | 1,245 | 5,000 | ... | ... | ... | ... | ... | .. | 208 | 2,192 | 13 | 32 |
| Mlanje | ... | | 300 | 182 | ... | ... | 226 | 188 | 218 | 2,620 | ... | |
| Blantyre | ... | ... | 120 | 66 | ... | ... | 3 | 6 | 183 | 922 | ... | ... |
| Chiradzulu | ... | ... | 85 | 55 | ... | .. | ... | ... | 95 | 1,400 | 1 | 4 |
| Zomba | ... | ... | 62 | 46 | ... | ... | ... | .. | 110 | 2,281 | ... | ... |
| Upper Shire | ... | ... | 45 | 63 | ... | ... | ... | ... | 40 | 560 | ... | ... |
| South Nyasa | ... | ... | 8 | 8 | ... | ... | ... | ... | 50 | 750 | ... | ... |
| Ncheu | ... | ... | 6 | 20 | ... | ... | ... | ... | 60 | 281 | ... | ... |
| Dedza | ... | ... | 42 | 49 | ... | . | ... | ... | 109 | 698 | 25 | 147 |
| Fort Manning | ... | ... | ... | ... | ... | ... | .. | ... | 5 | ... | ... | ... |
| Lilongwe | ... | ... | ... | ... | ... | ... | 1 | 1 | 117 | 1,341 | ... | ... |
| Dowa | ... | ... | 1,070 | 1,081 | ... | ... | ... | ... | 35 | 610 | 3 | 2 |
| Kota Kota | ... | ... | ... | ... | ... | ... | ... | ... | 7 | 15 | 4 | 16 |
| Kasungu | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... |
| Mzimba | ... | ... | ... | .. | ... | ... | ... | ... | 5 | 75 | 3 | 36 |
| West Nyasa | ... | ... | .. | .. | 1,300 | 1,607 | ... | ... | 10 | 140 | ... | ... |
| North Nyasa | ... | ... | 33 | 29 | .. | ... | ... | ... | ... | ... | ... | ... |
| Total | 1,547 | 8,200 | 1,997 | 1,920 | 1,300 | 1,607 | 230 | 195 | 1,355 | 14,631 | 49 | 237 |

## EUROPEAN AGRICULTURE—CONTINUED.

| Name of district. | Legumes. | | | | | | | Oil Seeds. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total. | | *For food.* | | *For fodder* | | *For green manure* | Total. | | *For crushing.* | | *For food.* | |
| | Acres under crop. | Yield cwt. | *Acres under crop.* | *Yield cwt* | *Acres under crop.* | *Yield cwt.* | *Acres under crop.* | Acres under crop. | Yield cwt. | *Acres under crop.* | *Yield cwt.* | *Acres under crop.* | *Yield cwt.* |
| Lower Shire ... ... ... | 16 | 31 | *6* | *31* | ... | ... | *10* | 11 | 41 | *6* | ... | *5* | *41* |
| Chikwawa ... ... ... | 1 | 2 | *1* | *2* | ... | ... | .. | ... | ... | ... | ... | ... | ... |
| Central Shire ... ... | 88 | 57 | *28* | *57* | ... | ... | *60* | ... | ... | ... | ... | ... | ... |
| Cholo ... ... . | 595 | 9,448 | *65* | *8,386* | *13* | *1,062* | *517* | 29 | 88 | *19* | *44* | *10* | *44* |
| Mlanje ... ... ... | 996 | 214 | *78* | *150* | *10* | *64* | *908* | ... | ... | ... | ... | ... | ... |
| Blantyre ... ... ... | 299 | 34 | *19* | *12* | *80* | *22* | *200* | 20 | 60 | ... | ... | *20* | *60* |
| Chiradzulu ... ... | 259 | 843 | *81* | *243* | *112* | *600* | *66* | 1 | 12 | ... | ... | *1* | *12* |
| Zomba ... ... ... | 355 | 634 | *113* | *532* | *33* | *102* | *209* | 26 | 79 | *4* | *5* | *22* | *74* |
| Upper Shire ... ... | 1 | ... | *1* | ... | ... | ... | ... | 2 | 5 | ... | ... | *2* | *5* |
| South Nyasa ... ... | 130 | ... | ... | ... | ... | ... | *130* | ... | ... | ... | ... | ... | ... |
| Ncheu ... ... ... | 42 | 10 | *1* | *10* | ... | ... | *41* | 25 | 80 | *25* | *80* | ... | .. |
| Dedza ... ... ... | 26 | 55 | *14* | *55* | ... | ... | *12* | 1 | ... | *1* | ... | ... | ... |
| Fort Manning ... ... | 45 | ... | *2* | ... | ... | ... | *43* | 4 | ... | ... | ... | *4* | ... |
| Lilongwe ... ... ... | 440 | 130 | *16* | *105* | *7* | *25* | *417* | 7 | 1 | ... | ... | *7* | *1* |
| Dowa ... ... .. | 85 | 11 | *5* | *11* | *50* | ... | *30* | 8 | 93 | ... | ... | *8* | *93* |
| Kota Kota ... ... ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Kasungu ... ... ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mzimba ... ... ... | 3 | 30 | *3* | *30* | ... | .. | ... | 2 | 3 | ... | ... | *2* | *5* |
| West Nyasa ... ... | ... | ... | ... | ... | ... | ... | ... | 4 | 12 | ... | ... | *4* | *12* |
| North Nyasa ... ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Total ... | 3,381 | 11,499 | *433* | *9,624* | *305* | *1,875* | *2,643* | 140 | 474 | *55* | *129* | *85* | *345* |

## EUROPEAN AGRICULTURE—CONTINUED.

| Name of district. | Tung Oil. | | Fruit Trees. | | Nut-Bearing Trees. | | Miscellaneous. | | Woodland Artificially Established |
|---|---|---|---|---|---|---|---|---|---|
| | Acres under crop. | Yield cwt. | Acres under crop. | Yield cwt. | Acres under crop. | Yield cwt. | Acres under crop. | Yield cwt. | Acres. |
| Lower Shire ... ... ... | 15 | ... | 8 | ... | ... | ... | ... | ... | 8 |
| Chikwawa ... ... ... | ... | ... | 37 | 6 | ... | ... | 3 | 2 | 17 |
| Central Shire ... ... | ... | ... | 8 | 190 | ... | ... | ... | ... | 70 |
| Cholo ... ... ... | 411 | ... | 87 | ... | 29 | ... | 8 | 60 | 4,764 |
| Mlanje ... ... ... | 154 | ... | 231 | 3,150 | ... | ... | ... | ... | 2,027 |
| Blantyre ... ... ... | 7 | ... | 17 | ... | ... | .. | 1 | 8 | 3,263 |
| Chiradzulu ... ... ... | 7 | ... | 4 | 2 | ... | ... | ... | ... | 1,970 |
| Zomba ... ... ... | 26 | 8 | 14 | 20 | ... | ... | ... | ... | 1,298 |
| Upper Shire ... ... ... | ... | ... | 2 | ... | ... | ... | ... | ... | 19 |
| South Nyasa ... .. ... | ... | ... | ... | ... | ... | ... | ... | ... | 247 |
| Ncheu ... ... ... | ... | ... | 6 | 5 | ... | ... | ... | .. | 353 |
| Dedza ... ... ... | ... | ... | 34 | 133 | .. | ... | 3 | 23 | 132 |
| Fort Manning ... ... | ... | ... | 14 | ... | ... | ... | ... | ... | 326 |
| Lilongwe ... ... ... | 4 | ... | 6 | ... | ... | ... | ... | ... | 2,065 |
| Dowa ... ... | ... | .. | 2 | ... | ... | ... | ... | ... | 215 |
| Kota Kota ... ... ... | ... | | 1 | 10 | .. | ... | ... | ... | 2 |
| Kasungu ... ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mzimba ... ... ... | .. | | ... | ... | | . | ... | ... | 22 |
| West Nyasa ... ... ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 |
| North Nyasa ... ... ... | ... | ... | ... | ... | ... | ... | ... | ... | 26 |
| Total ... | 624 | 8 | 471 | 3,516 | 29 | ... | 15 | 93 | 16,834 |

## NATIVE AGRICULTURE.

| District. | Seed Cotton | Rice | Wheat | Ground-nuts | Tobacco | Maize | Peas and Beans |
|---|---|---|---|---|---|---|---|
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| Lower Shire ... | 2,600 | | | | ... | | |
| Chikwawa ... | 2,349 | | | | ... | | |
| Central Shire ... | 333 | | | | ... | | |
| Cholo .. | 159 | | | | 13 | | |
| Mlanje ... | 114 | | | | 545 | | |
| Blantyre ... | 75 | | | | 192 | | |
| Chiradzulu ... | ... | | | | 680 | | |
| Zomba ... | ... | | | | 240 | | |
| Upper Shire ... | 40 | | | | 35 | | |
| South Nyasa ... | 89 | | | | ... | | |
| Ncheu ... | 164 | | | | 193 | | |
| Dedza ... | 412 | | | | 5 | | |
| Fort Manning ... | ... | | | | 182 | | |
| Lilongwe ... | ... | | | | 2,846 | | |
| Dowa ... | 692 | | | | 1,239 | | |
| Kota Kota .. | 146 | | | | ... | | |
| Kasungu ... | ... | | | | .. | | |
| Mzimba ... | ... | | | | ... | | |
| West Nyasa ... | ... | | | | ... | | |
| North Nyasa ... | 90 | | | | ... | | |
| Total | 7,263 | | | | 6,170 | | |

NOTE.—Maize is the staple foodstuff in most districts; groundnuts, rice, wheat, beans and various other crops are also grown by natives for local consumption, but it is impossible to make an accurate estimate of the quantities of any of these crops.

The above tobacco and cotton figures represent the quantities purchased in each district, and do not accurately reflect the production by districts, as many natives grow their tobacco and cotton in one district and sell in another.

## NATIVE LIVE STOCK.

| District. | Cattle. | Sheep. | Goats. | Pigs. |
|---|---|---|---|---|
| Lower Shire ... ... | 219 | 2,413 | 11,406 | 13,573 |
| Chikwawa ... | 176 | 1,521 | 7,947 | 9,067 |
| Central Shire .. ... | 1,234 | 504 | 5,711 | 343 |
| Cholo ... ... | 150 | 1,865 | 6,258 | 6,627 |
| Mlanje ... ... | 695 | 2,937 | 14,064 | 7,936 |
| Blantyre ... ... | 2,301 | 1,253 | 10,935 | 4,357 |
| Chiradzulu ... ... | 2,061 | 1,238 | 6,775 | 7,779 |
| Zomba ... ... | 1,273 | 891 | 1,287 | 342 |
| Upper Shire ... ... | 63 | 3,100 | 7,500 | 300 |
| South Nyasa ... ... | 434 | 2,070 | 2,500 | 65 |
| Ncheu ... ... | 13,960 | 2,076 | 17,187 | 4,683 |
| Dedza ... .. | *22,847 | *6,338 | *36,261 | *825 |
| Fort Manning ... . | 1,907 | *3,480 | *8,760 | *4,060 |
| Lilongwe . ... | *39,200 | *7,000 | *51,000 | *3,700 |
| Dowa ... ... | 18,200 | 8,100 | 38,500 | 4,800 |
| Kota Kota ... ... | 2,900 | 2,500 | 11,050 | 2,600 |
| Kasungu ... ... | 1,687 | 1,800 | 1,450 | 200 |
| Mzimba ... ... | 58,388 | 4,875 | 18,860 | 189 |
| West Nyasa ... | *2,192 | *136 | *1,105 | — |
| North Nyasa ... ... | 36,616 | 244 | 1,807 | 24 |
| Total | 206,503 | 54,341 | 260,363 | 71,470 |

*1935 figures; 1936 figures not available.

# LIVE STOCK OWNED BY EUROPEANS AT 31ST DECEMBER, 1936.

| District. | Cows and heifers. | Bulls. | Oxen. | Calves. | Pedigree cattle. | Horses. | Mules. | Donkeys. | Sheep. | Goats. | Pigs |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lower Shire ... ... ... ... ... | 1,291 | 21 | 215 | 353 | ... | ... | ... | 20 | 129 | 85 | 131 |
| Chikwawa ... ... ... ... .. | 202 | 2 | 59 | 98 | ... | ... | ... | ... | ... | 2 | ... |
| Central Shire ... ... ... ... ... | 30 | 4 | 22 | 22 | ... | ... | ... | 6 | ... | ... | 15 |
| Cholo ... ... .. ... ... | 1,503 | 44 | 787 | 612 | 13 | 2 | ... | 20 | 228 | 45 | 48 |
| Mlanje ... ... ... ... ... | 1,420 | 30 | 1,046 | 589 | 2 | ... | ... | 2 | 125 | 7 | 29 |
| Blantyre ... ... ... ... ... | 1,201 | 21 | 55 | 565 | 35 | 12 | ... | 4 | 20 | 3 | 79 |
| Chiradzulu ... ... ... ... ... | 637 | 14 | 360 | 338 | 4 | 2 | ... | 4 | 4 | 19 | 72 |
| Zomba ... ... ... ... ... | 1,020 | 19 | 526 | 365 | 75 | 22 | ... | 22 | 145 | 22 | 38 |
| Upper Shire ... ... ... ... ... | 8 | 1 | 3 | 5 | ... | ... | ... | 5 | 15 | 55 | 27 |
| South Nyasa ... ... ... ... ... | 85 | ... | 48 | 53 | ... | ... | ... | 1 | 34 | 79 | 6 |
| Ncheu ... ... ... ... ... | 275 | 9 | 128 | 134 | 2 | ... | ... | 5 | 56 | 8 | 92 |
| Dedza ... ... ... ... ... | 298 | 16 | 249 | 127 | 23 | ... | ... | 42 | 164 | ... | 149 |
| Fort Manning ... ... ... ... | 82 | 5 | 72 | 45 | ... | ... | ... | ... | 41 | 7 | 22 |
| Lilongwe ... ... ... ... ... | 314 | 12 | 156 | 91 | 1 | ... | ... | 39 | 45 | 68 | 101 |
| Dowa ... ... ... ... ... | 8 | 1 | 22 | 4 | ... | ... | ... | 4 | 95 | ... | ... |
| Kota Kota ... ... ... ... ... | 34 | 2 | 13 | 18 | ... | ... | ... | 2 | 36 | 1 | ... |
| Kasungu ... ... ... ... ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mzimba ... ... ... ... ... | 17 | 2 | 31 | 7 | ... | ... | ... | 6 | 6 | ... | 48 |
| West Nyasa ... ... ... ... ... | 14 | 2 | 13 | 3 | ... | ... | ... | ... | ... | ... | 28 |
| North Nyasa ... ... ... ... ... | 56 | 5 | 87 | 34 | ... | ... | ... | ... | 32 | ... | 25 |
| Total ... | 8,495 | 210 | 3,892 | 3,463 | 155 | 38 | ... | 182 | 1,175 | 401 | 910 |

# Native Tobacco Board.

*Appendix J.*

## STATEMENT OF RECEIPTS AND PAYMENTS, 1936.

### RECEIPTS

| | | | |
|---|---|---|---|
| BALANCE BROUGHT FORWARD FROM 1935 ... | | £14,310 0 10 | |
| *Revenue* | | | |
| Tobacco Tax ... ... ... | £13,779 7 6 | | |
| Sale of Tobacco Seed to Natives ... | 3,554 14 6 | | |
| Sale of Tobacco Seed to Europeans ... | 92 9 5 | | |
| Sale of Tobacco Leaf ... ... | 124 15 7 | | |
| Sale of Miscellaneous Seeds and Plants ... | 18 17 4 | | |
| Sale of Tobacco Booklet ... ... | 2 7 7 | | |
| Sale of Plants and Gardens Booklet ... | 31 0 9 | | |
| Sale of Tobacco Plants to Natives ... | 4 4 | | |
| Interest on Fixed Deposits ... ... | 140 0 0 | | |
| Miscellaneous Receipts ... ... | 29 8 8 | | |
| TOTAL REVENUE ... ... ... ... | | 17,773 5 8 | |
| ADVANCES RETURNED ... ... ... | | 326 10 11 | |
| BALANCE DUE TO TREASURY ... ... ... | | 591 18 8 | |
| | | £33,001 16 1 | |

### PAYMENTS

| | | | |
|---|---|---|---|
| *Personal Emoluments: European Staff* | | | |
| Agent and Senior Supervisor, £600 ... | £600 0 0 | | |
| Agricultural Superintendent, £550 ... | 508 6 8 | | |
| Eight Supervisors, £400 for ten years then £500 ... ... ... ... | 3,134 0 1 | | |
| Two Supervisors, £400 ... ... ... | 200 0 0 | | |
| Four Temporary Supervisors, £360 .. | 1,440 0 0 | | |
| Three Temporary Supervisors, one month @ £25 each ... ... ... ... | 75 0 0 | | |
| Clerk, £300 by £20 to £400 ... ... | 198 6 8 | | |
| Mr. Tylor, Gratuity ... ... ... | 300 0 0 | | |
| Allowance to Officer-in-charge, Lilongwe Experiment Station ... ... ... | 20 16 8 | | 6,476 10 1 |
| *Native Staff* | | | |
| 14 Clerks, rates and periods variable, £6 to £24 | 80 15 0 | | |
| One hundred and seventy-six Capitaos, rates and periods variable, £4 16 to £18 | 1,769 13 1 | | |
| 8 Watchmen, 7 @ £4 16/- and 1 @ £6 12/- | 38 6 0 | | |
| Two Messengers, 1 @ £7 4/- and 1 @ £6 12/- | 13 5 0 | | 1,901 19 1 |
| TOTAL PERSONAL EMOLUMENTS ... | | | 8,378 9 2 |
| *Other Charges* | | | |
| Travelling ... ... ... ... | 1,409 1 2 | | |
| Passages ... ... ... ... | 262 14 7 | | |
| Buildings, Lilongwe—Upkeep of ... | 188 4 6 | | |
| Seed and Experimental Plots, Mtiti ... | 36 19 0 | | |
| Seed and Experimental Plots, Capitaos ... | 64 0 0 | | |
| Lilongwe Experimental Station ... | 387 15 2 | | |
| District Experimental Work ... ... | 31 9 2 | | |
| Stationery and Printing ... ... | 130 18 0 | | |
| Implements and Equipment ... ... | 43 8 3 | | |
| Incidentals ... ... ... ... | 20 3 8 | | |
| Uniforms ... ... ... ... | 95 14 5 | | |
| Camp Equipment ... ... ... | 13 13 9 | | |
| Sanitation, Fort Manning ... ... | 6 8 0 | | |
| Purchase of Tobacco Seed ... ... | 137 0 10 | | |
| Tobacco Nurseries ... ... ... | 41 4 9 | | |
| TOTAL OTHER CHARGES ... ... | | | £2,868 15 3 |
| *Contributions* | | | |
| Nyasaland Stall, Empire Exhibition, Johannesburg ... ... ... | 50 0 0 | | |
| Zomba Experimental Station ... ... | 398 0 11 | | |
| Nyasaland Government, Clerical Assistance | 363 11 8 | | |
| European Police Officer, Travelling ... | 53 7 4 | | |
| Forestry ... ... ... ... | 40 19 7 | | |
| TOTAL CONTRIBUTIONS ... ... | | | 905 19 6 |
| *Central Buying Stations* | | | |
| Permanent Station Hands ... ... | 17 15 6 | | |
| Sanitation ... ... ... ... | 111 17 5 | | |
| Erection, Enlargement, Repairs and Clearing etc. ... ... ... ... | 113 4 8 | | |
| TOTAL CENTRAL BUYING STATIONS ... | | | 242 17 7 |
| *West African Market* | | | |
| Temporary Supervisor ... ... ... | 50 0 0 | | |
| Capitaos ... ... ... ... | 52 4 9 | | |
| Travelling ... ... ... ... | 116 12 4 | | |
| Quarters for Capitaos ... ... ... | 11 2 8 | | |
| Cart Shed ... ... ... ... | 13 13 9 | | |
| Implements and Equipment ... ... | 1 7 10 | | |
| Tobacco Nurseries ... ... ... | 32 13 4 | | |
| Zomba Central Buying Station, Erection, etc. | 406 6 6 | | |
| Miscellaneous ... ... ... ... | 1 0 0 | | |
| TOTAL WEST AFRICAN MARKET ... | | | 685 1 2 |
| *Special Expenditure* | | | |
| Cash Chests ... ... ... ... | 19 19 11 | | |
| Tents ... ... ... ... | 34 3 5 | | |
| Pedal Cycles ... ... ... ... | 13 0 0 | | |
| House (including furniture) on Zomba Experimental Station ... ... | 70 19 0 | | |
| Buildings, Mponela and Nsaru ... ... | 6 18 4 | | |
| Eight Latrines ... ... ... | 38 13 8 | | |
| Boreholes ... ... ... ... | 400 0 0 | | |
| TOTAL SPECIAL EXPENDITURE ... ... | | | 583 14 4 |
| TOTAL EXPENDITURE ... ... ... | | | 13,664 17 0 |
| ADVANCES MADE ... ... ... | | | 224 4 4 |
| BALANCES CARRIED FORWARD TO 1937 | | | |
| Current Account at Bank ... ... | 10,112 14 9 | | |
| Fixed Deposits at Bank ... ... | 9,000 0 0 | | 19,112 14 9 |
| | | | £33,001 16 1 |